FEBRUARY

THE JOURNAL
OF THE
AMERICAN DENTAL ASSOCIATION
AND
THE DENTAL COSMOS

Peridental Membrane Reattachment—*Skillen and Lundquist*
Thermal Agents—*Moose*
Diet in Gingivitis—*Kirkpatrick*
Masticatory Efficiency in Prosthesis—*Thompson*
Syphilis of Bedouins—*Hudson*
Temporomandibular Roentgenograms—*Higley*
Practical Castings—*Sturdevant*
Formula for Ideal Occlusion—*Maxwell*
Peridental Trauma and Disuse Atrophy—*Bignell*
Report of Research Commission
Association of Dental Editors—*Gies*

EDITORIALS
Our Associate Editor—"Dentistry Written Out"—Salve!

COUNCIL ON DENTAL THERAPEUTICS
Toxic Potentialities of a Fluoride Dentifrice

BUREAU OF PUBLIC RELATIONS
Home Care of the Mouth—*Van der Molen*

DENTAL ECONOMICS
Iowa Supreme Court Decision

REMOVED FOR

CONTENTS

John B. LaDue, D.D.S. ..... Frontispiece

ORIGINAL COMMUNICATIONS

An Experimental Study of Peridental Membrane Reattachment in Healthy and Pathologic Tissue.
By William G. Skillen, D.D.S., and G. R. Lundquist, M.S., D.D.S. 175
The Rational Therapeutic Use of Thermal Agents with Special Reference to Heat and Cold.
By Sanford M. Moose, D.D.S., F.A.C.D. 185
Diet in Relation to Gingivitis: Field Observations in New Guinea.
By K. M. Kirkpatrick B.D.S., D.D.Sc. 197
Masticatory Efficiency as Related to Cusp Form in Denture Prosthesis.
By Morris J. Thompson, D.D.S. 207
Bejel—The Childhood Syphilis of the Bedouins: Oral Manifestations.
By E. H. Hudson, M.D. 219
Practical Application of a New and Scientific Method of Producing Temporo-mandibular Roentgenograms.
By L. B. Higley, B.A., D.D.S., M.S. 222
A Simple Control for Practical Castings.
By R. E. Sturdevant, D.D.S. 231
A Biologic-Mathematical Formula for an Ideal Occlusion.
By George H. Maxwell, D.D.S. 238
Diagnosis and Reconstruction Technic for the Treatment of Interarticular and Peridental Trauma and Disuse Atrophy.
By Kenneth A. Bignell, D.D.S. 256
Report of the Research Commission of the American Dental Association 269
Address of the President of the American Association of Dental Editors, 1935-1936.
By William J. Gies, Ph.D., Sc.D., LL.D., F.A.C.D. 282
Proceedings of the Sixth Annual Meeting of the American Association of Dental Editors 290
Report of Cases in Oral Surgery.
By Harry M. McFarland, D.D.S. 292
The Pulp Canal Problem in American Colleges.
By Clyde Davis, A.M., M.D., D.D.S. 294
Tumor in Palate: Report of Case.
By E. Williams, D.D.S., and J. E. Williams, B.S., D.D.S. 295

EDITORIAL DEPARTMENT

Our Associate Editor.—"Dentistry Written Out."—The Patient's Dilemma.—Salve! 296-304

Practice in Paragraphs 304

COUNCIL ON DENTAL THERAPEUTICS

Accepted Dental Remedies 306
Toxic Potentialities of a Fluoride Dentifrice 307
El-Cre-Sol—Not Admissible to A.D.R. 310
Beechnut Oralgene Chewing Gum—Not Acceptable for A.D.R. 311

BUREAU OF PUBLIC RELATIONS

Loss of Teeth Through Improper Home Care of the Mouth.
By H. Van der Molen 313
Teeth Vs. Behavior.
By Frank L. Beals 317

DENTAL ECONOMICS

Iowa Supreme Court Decision 320
Dental Health Education Activities in Georgia 322
National Income in the United States 325

Directory of State Society Officers and Dates of Meetings, 1936-1937 328

CURRENT LITERATURE

Abstracts 336

MISCELLANY

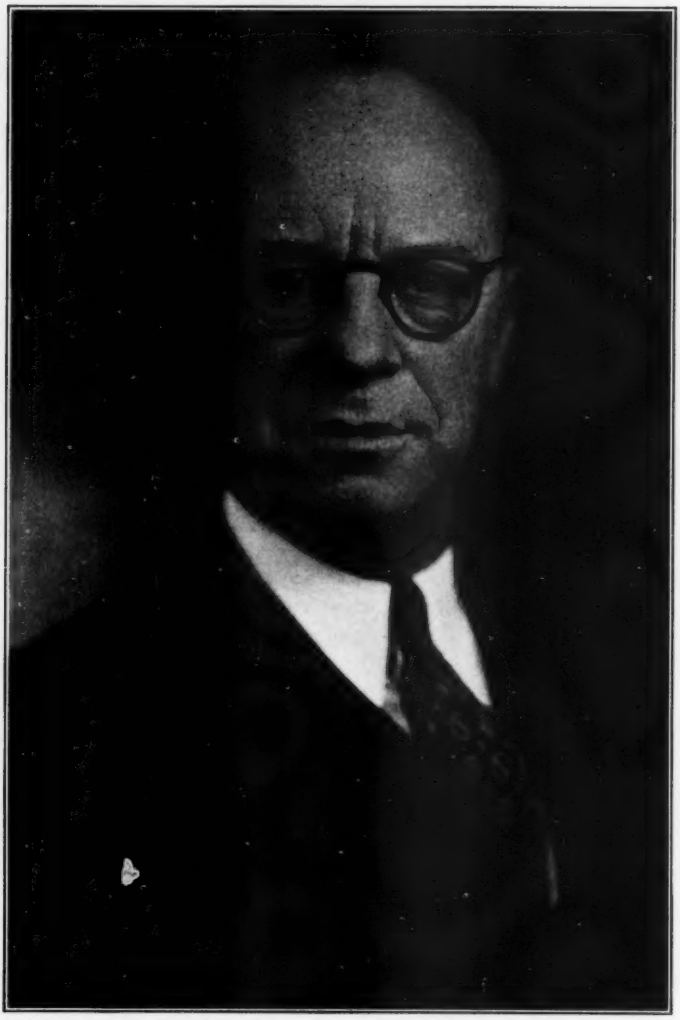
Book Review 339
News 339

Announcements 340

ADVERTISEMENTS

Index to Advertisements A-51
Classified Section A-38

The Journal of the American Dental Association and The Dental Cosmos. Vol. XXIV, No. 1. Published by the American Dental Association, 212 East Superior Street, Chicago, Ill. Yearly subscription $5.00. Entered as second-class matter, May 1, 1928, at the postoffice at Chicago, Ill., under the act of Aug. 24, 1912. Published monthly. Copyright, 1937, by the American Dental Association.



JOHN B. LA DUE, D.D.S., Chicago, Ill.
President of the Chicago Dental Society

THE JOURNAL *of the*
AMERICAN DENTAL ASSOCIATION
and THE DENTAL COSMOS

Vol. 24 FEBRUARY, 1937 No. 2

Original Communications

AN EXPERIMENTAL STUDY OF PERIDENTAL MEMBRANE REATTACHMENT IN HEALTHY AND PATHOLOGIC TISSUES*

By WILLIAM G. SKILLEN, D.D.S., and G. R. LUNDQUIST, M.S., D.D.S.,
Chicago, Ill.

A REVIEW of the literature concerning chronic suppurative pericementitis, or so-called pyorrhea, indicates the belief of many authors that more or less of the detached soft tissue side of a pus pocket may be reattached to the tooth surface as a result of treatment, much of the pocket thus being eliminated.

Among the most recent of these writers are Leonard[1] (1935) and Yeretsky[2] (1936), who express their belief in this possibility, but, like others, give no concrete evidence to support it.

Box,[3] some time ago, considered the accidental reattachment of torn or separated tissues as analogous to the healing of pus pockets. He used examples of such healing to support his belief that reattachment following treatment of pus pockets was possible. The reattachment of torn tissue to the tooth is not unknown. We,[4] as well as others, have reported similar reattachment; for instance, that which occurs, temporarily at least, in replanted teeth. But even these cases, healthy as the tissues may be at the beginning, are seldom wholly successful, failure of reattachment, especially in the gingival region, being very frequent. At the best, it is a question whether such cases may be accepted as evidence of the possibility of reattachment of pocket tissue. Rather, they probably constitute evidence to the contrary.

*From the Histologic Department, Northwestern University Dental School.

1. Leonard, H. J.: Periodontia Treatment for Maximum Reattachment, J.A.D.A., 22:602-607 (April) 1935.

2. Yeretsky, Willa: Diagnosis and Evaluation of Treatment in Periodontoclasia, J.A.D.A., 23:1185-1194 (July) 1936.

3. Box, H. K.: Treatment of Periodontal Pocket, Bull. 10 Canadian Dental Research Foundation, University of Toronto Press, 1928.

4. Skillen, W. G., and Lundquist, G. R.: Replanting Dog Teeth, J. D. Res., 14:177-178 (June) 1934.

Recently, Bodecker and Lefkowitz[5] have shown a fairly satisfactory reattachment of connective tissue in a replanted tooth. They also present a case of epithelial reattachment to the enamel. The evidence offered on the latter point does not seem conclusive. In the complete absence of enamel, there is nothing to indicate with any assurance that the tissue represented as the cuticle was in continuity with the enamel.

Box[3] attempted also to establish the possibility of reattachment following the treatment of a case of pyorrhea. The case described by him was criticized by Gottlieb[6] as being rather weak evidence because no record had been made of the actual pocket depth before or after treatment; a criticism which we believe to be justified.

When reattachment is mentioned, we presume that a connective tissue attachment to the tooth surface is implied, although this is seldom specified. Only such a type of attachment is of real value, as may readily be understood. Box[3] apparently agrees with this. He seems to be convinced that most cases of reattachment are epithelial and he believes that these do not have the permanency that a connective tissue attachment would have. An epithelial attachment may be nothing more than a mere agglutination of the soft tissues to the root surface, which, at best, probably constitutes a potential pocket and frequently a relatively deep one. Indeed, it is doubtful that such an arrangement should be considered a reattachment at all.

As much more concrete evidence in support of the reattachment theory is

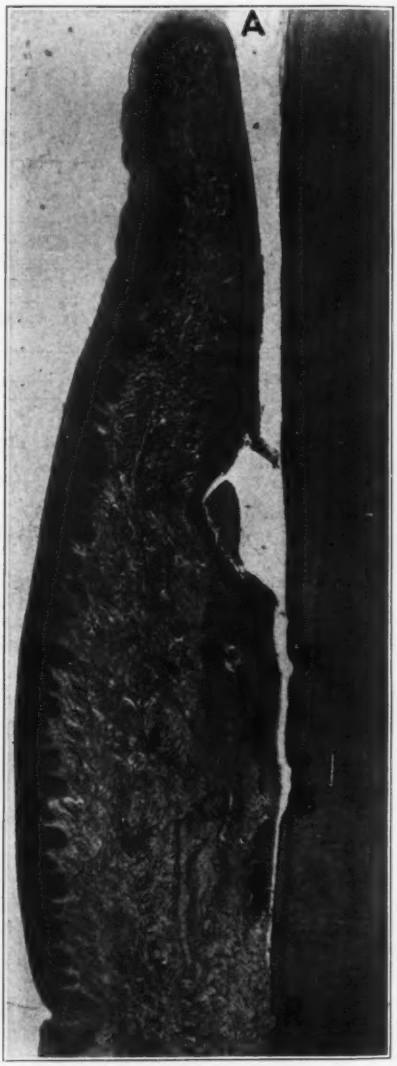


Fig. 1.—Dog material; one week healing period following sodium sulfide treatment; original pocket, 8 mm. deep; present pocket, *A-B*, 7 mm.; epithelium absent from *C-B*. *B-R*, region of connective tissue reattachment of 1 mm.; *R*, resorption lacunae.

5. Bodecker, C. F., and Lefkowitz, William: Gingival Reattachment to Enamel and Its Relation to Operative Dentistry, D. Cosmos, 77:1106-1114 (Nov.) 1935.

6. Gottlieb, Bernhard: Peridental Pyorrhea and Alveolar Atrophy, Fortschr. d. Zahnheilk., 5:351-406 (Part 1), 1929.

apparently necessary, two sets of experiments were undertaken to determine (1) what would happen in the detachment of healthy tissues, and (2) what would happen in pathologic human tissues after treatment.

In the first experiment, dogs with healthy tissues were used and two different operations were carried out. In each instance, the gingival tissues were separated from the tooth surface to measured depths of from 8 to 10 mm. (i. e., artificial pockets were formed by passing a sharp instrument along the root surface). The lateral spread of this cut never exceeded 4 mm. and was limited to one surface, usually the labial, of the tooth.

In some instances, nothing further was done, beyond creating the pocket. In others, including the human pathologic cases, curettement of the tissues was resorted to, followed by an application of sodium sulfide in an attempt to

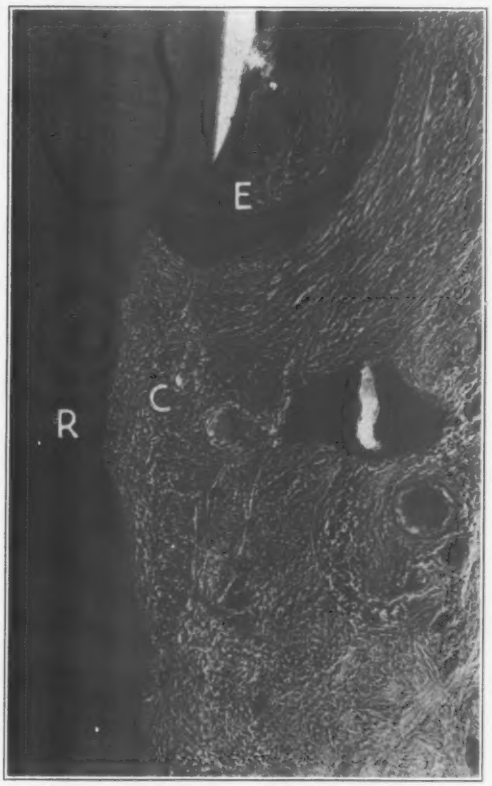


Fig. 2.—Dog material; condition of tissues in area of reattachment after two months' healing period; *R*, resorbed area of root surface covered by a thin layer of new cementum; *C*, new connective tissue fibers; *E*, epithelium.

Fig. 3.—Dog material; two weeks' healing period following sodium sulfide treatment; original pocket depth, 10 mm.; present pocket depth, *A-B*, 6.5 mm., covered by epithelium; latter adherent to root *B-C*; *C-X*, area of reattachment.

dissolve any remaining epithelium. The technic used was that recommended by McCall[7] and Miller and Sorrin.[8]

A groove was cut in the tooth surface at the level of the crest of the gingivae to make it possible to obtain accurate measurements of the pocket depth before and after treatment, and to record any subsequent shrinkage of the tissues. Clinical measurements were correlated with microscopic measurements to make the records as accurate as possible.

The measurements given here are relative. In some instances, if healing had progressed for a time, there was a shrinkage of the soft tissue; which accounted for most of the reduction in pocket depth. This was particularly true in the human case reported here. Such shrinkage must be taken into account in determining the amount of reattachment.

The material, in the case of the dog, covered healing periods of from one to three weeks, and one to four months, and in the human case about three and one half weeks. Because of the large amount of animal material, it is feasible to describe only typical cases of intervals from one and two weeks and two months, which represent very fairly what occurred.

Figure 1 represents an animal case selected from the one-week period of healing. Sodium sulfide was used in this particular instance. The artificial pocket, when created, measured 8 mm. and the subsequent measurements indicated a reattachment of connective tissue of approximately 1 mm. This left a pocket (*A-B*) of about 7 mm., covered inadequately by epithelium. No epithelium

7. McCall, J. O.: Improved Method of Inducing Reattachment of Gingival Tissues in Periodontoclasia, D. Items Int., 68:342-362 (Nov.) 1925.

8. Miller, S. C., and Sorrin, S.: Action and Use of Sodium Sulphid Solution as Epithelial Solvent, D. Cosmos, 69:1113-1116 (Nov.) 1927.

Fig. 4.—Dog material. Two weeks' healing period with no treatment of artificially created pocket; original pocket depth, 7 mm.; present pocket depth, *A-B*, 5 mm., covered by epithelium; latter adherent to root *B-C;* area of reattachment *C-D* about 2 mm.

existed over the lower half of the pocket and the connective tissue in this region was definitely inflamed.

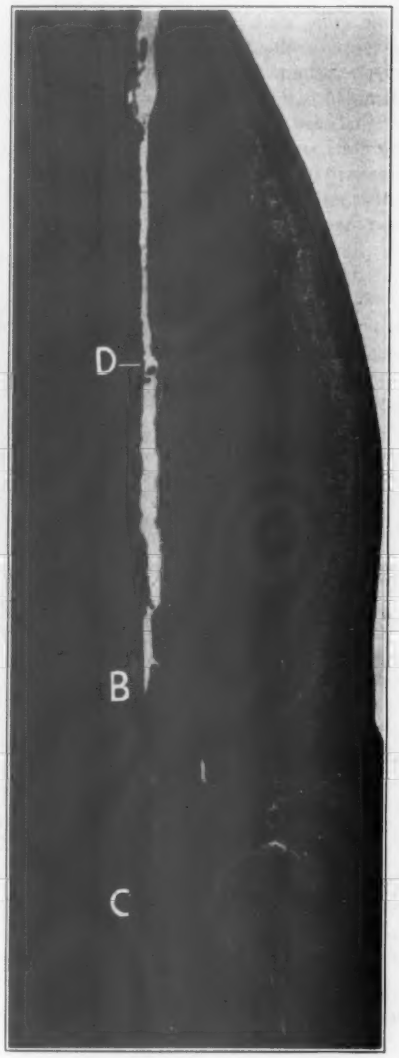


Fig. 5.—Dog material; two months' healing period with no treatment of artificially created pocket; original pocket depth, 8 mm.; present pocket depth, *A-B*, 6 mm.; area of reattachment, *B-C*, 2 mm. *D*, calculus.

It is recognized that this length of time (one week) may be insufficient to determine the final outcome and that given a longer period for healing, the denuded, inflamed, connective tissue might have become reattached. In the light of subsequent occurrences, as will be seen, the epithelium apparently proliferates so quickly that the various tissue changes which must take place before the connective tissue may be reunited to the tooth surface do not occur. These various changes (Fig. 2) seem to consist of a reorganization of the connective tissue, with development of new connective tissue fibers; more or less resorption of the tooth surface, and then repair of this surface with new secondary cementum, in which are enclosed the new fibers of the connective tissue. As these changes do not appear in the human material, it is possible that, in the dog material, they are the result of the injury. They correspond closely to the defects which arise in replantation.

Figure 3 illustrates the same kind of operation as described above, but following a healing period of two weeks. The tissues had been detached to a depth of 10 mm. In comparison with the one-week case described above, this case perhaps indicates something of the sequence of events which seem to have occurred most frequently.

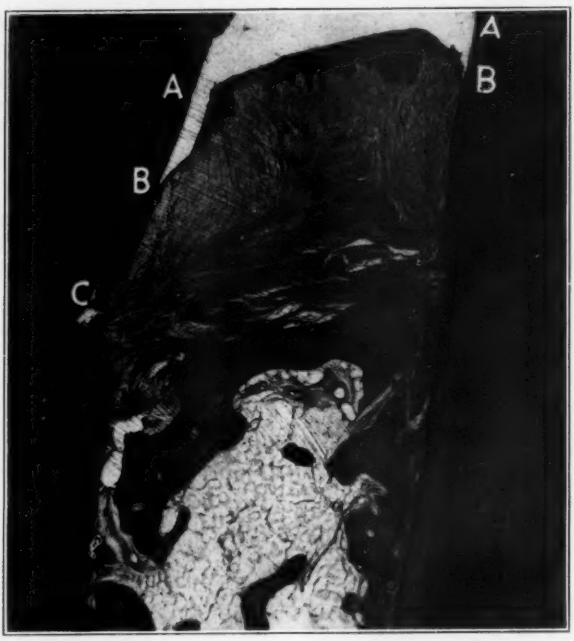


Fig. 6.—Human pathologic material; three and one-half weeks' healing period following sodium sulfide treatment; original pockets, 4 and 4.5 mm. deep; present depth, 3.3 and 4.2 mm., respectively, *A-B;* epithelium adherent to root *B-C.*

Here, the entire still detached tissue (*A-B*), now 6.5 mm. in depth, is cov-

Fig. 7.—Typical illustration of chronic suppurative pericementitis; *E-A* and *E-B*, pockets. *A-C* and *B-D*, attached transseptal fibers of peridental membrane; *X*, bone crest; *F*, food débris and calculus.

ered by epithelium, which becomes somewhat imperfect in the deepest part of the pocket. For a short distance, 3 mm. below (*B*), it is apparently adherent to the root surface (*C*). Below (*C*) for a distance of approximately 1.5 mm., the new connective tissue has become reattached to the tooth surface, a thin layer of new cementum having been formed over the resorbed old tissue. Above (*B*) are a few unrepaired Howship's lacunae, indicating that resorption was in progress up to the time the epithelium descended over the denuded connective tissue, when all further changes in the hard tissue necessarily cease. The connective tissue underlying the epithelium is still somewhat inflamed, but less so than in the first instance. In this case, then, only 1.5 mm. of a connective tissue reattachment occurred, a 6.5 mm. pocket lined more or less imperfectly by epithelium remaining.

Figure 4 represents the best results obtained from cases in which, after the creation of the artificial pocket, no treatment was carried out. The healing period in this case is again two weeks and the pocket originally was 7 mm. in depth.

A little more connective tissue reattachment, about 2 mm. (*B-C*), took place here with the formation of a relatively thick layer of new cementum.

The pocket (*A-B*), now 5 mm. in depth, is lined by a fairly thick epithelium, which, for a short distance, 0.5 mm., below (*B*), appears to be adherent to the tooth surface. The underlying connective tissue is still inflamed.

Figure 5 illustrates results after a two months' healing period. No treatment was carried out in this case after the cutting away of the tissues from the root surface. The artificial pocket was 8 mm. deep and now is about 6 mm.; which indicates a reattachment of about 2 mm. of connective tissue.

There was considerable resorption of the tooth surface, which now is covered by a very thin layer of cementum, into which extend the delicate new fibers.

Fig. 8.—*A*, bottom of pocket; *B*, close to apex of tooth. From *A* to *B*, the labial plate of bone has been lost, but the peridental membrane is still attached to the root surface.

The remaining pocket is covered by a relatively complete, though irregular, layer of epithelium, which, at the base of the pocket, appears to be proliferating

into the new fibrillar tissue in that region (Fig. 2). The subadjacent connective tissue is mildly inflammatory.

These experiments on the healthy tissues of dogs indicate that it is only possible to obtain a very small area of connective tissue reattachment to the tooth surface.

The reason for this seems to be that before all the changes necessary for reattachment can take place, the epithelial tissue proliferates over the denuded connective tissue. This makes impossible any further connective tissue reattachment in this region. The few experiments carried out on human pathologic tissue tend to support these conclusions.

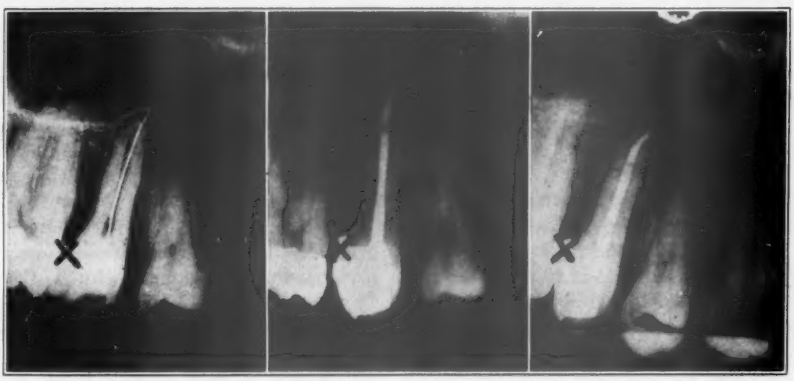


Fig. 9.—Apparent development of pocket and subsequent reattachment.

Figure 6 illustrates one of the most satisfactory results of treatment of human pathologic pockets by curettement and the application of sodium sulfide. The original pockets were 4 and 4.5 mm. deep, respectively. Now the depth of the actually detached portions is 3.3 and 4.2 mm., respectively. Shrinkage of the tissues almost makes up for this discrepancy. Below the bottom of these pockets, the epithelium apparently adheres to the root surface to a depth of 1.2 and 1.4 mm., respectively. This means that either the epithelial tissue has increased to a small extent (0.5 and 0.1 mm., respectively) or the original measurements of the pockets did not include all of it. We are inclined to believe that the former is true, because it is questionable that an epithelial attachment is sufficiently strong to resist the passage of an instrument between it and the tooth surface. There has been no resorption of the tooth surface and no new cementum formation is observable. The connective tissue in this case is only mildly inflammatory. It is probable that here again the epithelium has proliferated over the denuded surface of the connective tissue, any reattachment of the latter being thus prevented. What attachment there is is of an epithelial type.

This study, therefore, seems to show that after treatment, little or no connective tissue reattachment occurs in either healthy or pathologic gum and peridental membrane structures. Growth of epithelium over the denuded connective tissue surface, which seems to be relatively rapid, prevents reattachment of the latter. Of course, other factors, which

are indeterminable, may enter into the situation.

To a certain extent, an epithelial attachment or reattachment to the root surface is possible, but never over the full extent of the detached or denuded surface. In other words, after treatment, there will always exist a pocket of variable depth. There is no evidence that an epithelial reattachment occurs on the enamel.

Although not forming an essential feature of this investigation, the roentgenogram is frequently offered in evidence, not only of pocket extent, but also of reattachment. In itself, this evidence is of doubtful value. Box[3] presents such an instance, apparently presuming that the regeneration of the bone, which the roentgenogram demonstrated as having occurred, indicates reattachment of connective tissue.

Figure 7 represents a rather typical case of chronic suppurative pericementitis with relatively deep pockets terminating respectively at *A* and *B*. From *A-C* and *B-D*, there is a band of tissue, the transseptal fibers of the peridental membrane, still attached to the root surface. An unwary person, in looking at a roentgenogram of this case, might be led to believe that these pockets extended to *C* and *D*, respectively, instead of to *A* and *B*. With the reduction of the inflammatory reaction in this case, it would be possible to have a certain amount of bone regeneration in the region (*A-C* and *B-D*) of the still attached and relatively healthy fibrous tissue. Such an occurrence does not mean a reattachment of the connective tissue nor a reduction of pocket depth. It merely indicates regeneration of a certain amount of bone in originally attached and comparatively healthy tissue.

Figure 8 illustrates a similar situation. Here, most of the labial plate of bone has been lost. But the connective tissue from *A*, the bottom of the pocket, to *B*, the bone crest, is still attached to the root surface. After removal of the causes of its resorption, the bone here might also regenerate. This would not mean a reattachment of tissue to the root surface nor obliteration of the pocket.

Figure 9, left and center, seems to show the development of a very deep pocket with considerable loss of bone. At right there is shown complete regeneration of the bone and seemingly a reattachment. As a matter of fact, exploration of the tissues during this course of events showed that no pocket ever developed, and the peridental membrane attachment remained approximately at the enamel-cemental junction. It was simply a matter of bone resorption induced by the inflammation present in the gum tissue. On removal of the cause of the inflammation (an overhanging filling), the bone regenerated.

From these standpoints, the roentgenogram does not seem to offer satisfactory evidence for reattachment.

CONCLUSIONS

These experiments on healthy tissues of the dog, at best, indicate a reattachment of no more than 2 mm. of connective tissue.

Pockets of from 5 and 7 mm. depth existed at the end of the healing periods.

Epithelium seems to proliferate and cover the denuded tissue so rapidly that all further reattachment of connective tissue is prevented.

In the human material, there were no observable indications of a reattachment of connective tissue.

The pockets, if the shrinkage of the tissue which frequently follows reduction of the inflammation is discounted, remained about the same.

Epithelium in the deeper part of the pockets may hug closely or seem to adhere to the root surface.

There is no observable evidence of an epithelial reattachment to enamel.

The roentgenogram alone does not afford acceptable evidence either of detachment or reattachment of tissues.

THE RATIONAL THERAPEUTIC USE OF THERMAL AGENTS WITH SPECIAL REFERENCE TO HEAT AND COLD*

By SANFORD M. MOOSE, D.D.S., F.A.C.D., San Francisco, Calif.

TWENTY-ONE years of observation and use of thermal agents and their resultant efficacy has prompted the following discourse on a subject that I realize is highly controversial. In fact, the very controversial nature of this subject should bring ample discussion in future literature and possibly lead to a consistent system of application.

In considering thermal agents, I have chosen to confine myself to the fundamental generalities, heat and cold, rather than specific medicaments which would be merely incidental to the actual thermal agent. Unfortunately, some fundamental principles are overlooked by the professions embracing the healing art, and to this single fact is due the controversies over systems of treatment. I appreciate the desirability of differences of opinion, also the merit of constructive criticism, without which there could be no progress.

Controversies of this type frequently find vent outside professional bounds, and when purely medical problems become so controversial that the laity is attracted by the wide variation of professional opinion on one subject, only detrimental reaction can be expected. There are countless occasions when the simple subject of the judicious use of hot or cold compresses has been the spark which ignited the flame, ending in disagreeable litigation.

Have you ever been subjected to the scathing criticism of a certain family or group of patients because of some unpleasant postoperative sequelae? Fortunately, or unfortunately, the laity has been educated to the belief that unpleasant postoperative sequelae have no place within the realm of dentistry, and that it is a foregone conclusion that all patients should have uneventful recoveries, and finally that fatalities should never result from oral postoperative infection. This inherent belief has placed the rank and file of the profession always on the defensive. A great number of the medical profession have aided materially in overcoming this illusion, but there are still too many willing to foster that opinion.

The slow or unfavorable progress of a case often causes some member of the family to call in a medical or a dental consultant. The average case by this time has assumed alarming proportions, having passed through its slower localizing period. After the physician or dentist as-

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 15, 1936.

certains the treatment being followed, without explanation or comment the treatment is ordered changed from cold to hot compresses; or the use of heat is discredited by ordering a change to cold. If, in the first instance, there was justification, a few moments' explanation would keep the first doctor from disrepute or possible litigation, should the case terminate unfortunately.

The dental institutions of yore have inculcated the dogma of no extra-oral drainage so deeply in the minds of some of us who can remember the teachings and admonitions of two decades ago that the fear has become inherent and descended through the subsequent generation of dentists. This fact, I believe, is responsible for a too prolonged abortive treatment in many cases of suppurative cellulitis and osteomyelitis.

I have seen many patients become more toxic and physically exhausted through zealous efforts to prevent abscess formation by the use of ice which rendered impotent the only defensive means of preventing further systemic absorption by localization. It frequently happens in such cases that the second doctor on the case discontinues the applications of ice and uses heat. This subject must be considered from the onset as a potential surgical problem and treated as such during the primary routine treatment in view of this eventuality. The early recognition of the need for drainage may prevent deformity due to loss of structure and not infrequently save a life.

Let us now scrutinize the two thermal agents most frequently used therapeutically, as it is impossible to consider the effects of heat and cold separately. Cold is usually applied in one of two ways: by the use of ice chips in a rubber fabric bag, or by employment of cloths chilled by contact with the ice. Heat may be applied in several forms: the hot water bag, electric pad, heat lamps, irrigants, poultices and many other forms of compresses. Solutions most frequently used extra-orally in the compressing vehicle are boric acid, magnesium sulphate, lotion of lead and opium and aluminum acetate. The compressing medium should possess good absorbent qualities and be sufficiently large to completely cover the entire region. This should not be applied until the skin has been treated with cold cream or vaseline unless absorption of the medicament in the compressing solution is anticipated or desired. The compress should be covered with oil silk or some other nonabsorbent material, over which a hot water bag can be placed to keep the compress from cooling too rapidly.

Let us consider the most logical reasons for which ice would be selected: (1) the relief of pain; (2) reduction or prevention of swelling; (3) inhibition of incubation of bacteria. Ice as an analgesic is capable of relieving pain by reason of its property of refrigeration, but there is danger of gangrene, due to circulatory stasis.

If we analyze the physiologic reason of postoperative pain, we see that, in certain types of inflammatory processes, an optimum temperature somewhere between body temperature and refrigeration may be obtained by the use of ice, which will be beneficial at a certain postoperative period.

The physiologic response to surgical trauma is hyperemia and simultaneous edema. This engorgement of the tissues may produce pressure on the peripheral nerves which manifests itself in the form of pain.

If, in chilling the tissues, we impede the circulation to the affected part, intercellular tension is decreased, with subsequent diminution of pressure on nerve fibers and distention of the tissues. By the same physiologic process, this may

inhibit healing by depriving the injured tissues of increased circulation, which we must recognize as nature's response to an injury, and in which is carried all of the elements of regeneration and bacterial defense. With the latter facts well in mind, we should use ice with discretion.

That bacterial incubation could be sufficiently affected by conservative application of ice compresses to offset the beneficial effect of maintaining normal circulation to an infected part is something I am not at present willing to concede. Staphylococci and streptococci will grow in a suitable environment at temperatures far in excess of that to which it would be safe to expose human tissues.

To reduce the temperature of an infected part below that would seriously jeopardize living tissues and be a factor in the question of ultimate healing. I am decidedly in favor of maintaining physiologic processes.

Among the most frequent acute conditions for which thermal agents are applied at the onset is interstitial cellulitis. This, of course, embraces the preoperative or postoperative anginas, periostitis, ostemyelitis, etc.

A most important consideration in the use of ice for the abortive treatment of intercellular abscesses is the time element and the effect of retained intercellular infection on the general condition of the patient.

In considering this subject, due cognizance has been given the clinical opinion of many men engaged in the practice of oral surgery and exodontia as well as prominent members of the medical profession closely associated with dentistry.

A questionnaire was sent to a group of these men embracing such general and fundamental questions as: Do you believe that the extra-oral application of heat or cold on phlegmonous tissue of the jaws has any appreciable influence on the incubation of bacteria? What physiologic theory would you advance if asked why you prescribed ice compresses, and why you prescribed hot compresses? What, in your opinion, would be the relative influence of hot or cold compresses on postoperative hemorrhage, and what relative effect would you anticipate in the application of hot or cold solutions directly to the wound? Do you believe that the immediate postoperative or postextraction application of hot or cold compresses would be a predisposing factor in acute suppurative cellulitis or a subsequent osteomyelitis?

The answers are very illuminating and are presented in abstract as a part of this discussion.

Johnson does not believe that the question of the effect of extra-oral application of heat or cold on incubation can be answered scientifically. He writes:

> The variation either way from the optimum temperature has an inhibiting influence on the parasitic bacteria. In certain strains, an elevation of a very few degrees above the optimum has a very destructive effect on bacteria, and there is also a marked inhibitory action if the temperature is brought below the optimum value. It has been stated that measurement by means of a thermocouple has shown that heat applied externally never penetrates more than a quarter inch in depth into the tissues. If this is so, my opinion would be that heat or cold have relatively little or nothing to do with the incubation of bacteria in wounds of the jaws. I am in general agreement with the usual theory that the judicious use of cold is valuable in reducing hyperemia by causing contraction of the arterioles. . . . I believe that if used at all, it should be used early, for the prevention of edema resulting from trauma or contusion in operative procedure in relatively noninfective cases. I believe that it should not be used if rampant infection or much congestion is already present, as cold depresses the vitality of the part and may do

more harm than good. I believe that the judicious application of heat activates the vitality of the part by producing an active hyperemia, causing an increased vascular supply. The part is bathed in fresher, more oxygenated blood, which may reasonably be assumed to contain leukocytes, opsonins, antitoxins and other antibodies through which the bacteria and their toxins may be neutralized. Clinical experience also leads me to believe that heat relaxes the tissues and vessels, often reducing tension and pain. When applied to spastic muscles or to hard, infiltrated swelling, it assists in the restoration of healthy circulation, and softens and relaxes the tissues.

Wakefield uses cold compresses for the purpose of reducing circulation in the operative or phlegmonous region, thereby, "discouraging the extension of the inflammatory condition into the outer tissues, while heat tends to increase the incubation and encourage the travel of the process toward the surface where heat is applied." While using cold applications extra-orally in postoperative reactions, he prescribes the use of hot saline washes intra-orally to encourage drainage, the ice on the outside tending to abort a general cellular infection. After extraction under local anesthesia, he uses ice compresses "for the purpose of keeping whatever inflammatory process is present dormant until the procaine solution allows the tissues and circulation to again approximate normal." He uses heat in cases wherein swelling persists for seventy-two hours or more for localization purposes.

Gerrie believes that continuous cold applications tend to lower the temperature of the immediately adjacent tissues appreciably, and reduce them to below the temperature that is optimal for the development of disease-producing organisms. He also states that heat would tend to raise the temperature to the optimum both for the inflammatory processes and the organisms. On this premise, he favors the use of cold applications early in disease, or in very acute processes, thereby giving the body defense mechanism time to mobilize. As mobilization takes place primarily in the disturbed or injured region, the effect of chilling would be a factor in checking this physiologic process. He also favors the use of cold in traumatic swelling. Regarding hemorrhage, he believes that the application of heat or cold has little effect; that the immediate postoperative application of heat when the extraction has been surgically clean will help in hastening the inflammatory process, whereas cold would tend to retard the flow of blood to that part.

Hyatt advocates the use of cold compresses, not an icebag, for control of swelling following the removal of third molars. "The compresses, becoming warm and having to be changed every few minutes, allow normal circulation to continue." In septic inflammatory types, he does not advocate the application of cold.

Tholen states that, in his practice, heat is used in inflammatory conditions and cold in traumatic.

Gwinn uses cold packs to reduce ordinary swelling from trauma and hot packs externally together with hot irrigations intra-orally in treatment of severe infections.

Molt, on the premise that heat promotes and cold deters bacterial incubation, uses cold routinely, but when an inflammatory process does not respond readily to application of cold, immediately applies hot wet applications. He advocates the use of hot solutions intra-orally for inflammatory processes except where there is excessive bleeding, in which event he prescribes ice-cold solutions.

Fontaine, in weighing the relative merits of heat and cold, comes to the conclusion that cold should never be used

in phlegmonous processes. This he predicates upon the belief that cold compresses cause a contraction of the cellular tissues and the vascular system, thereby slowing up the circulation. When the circulation is retarded, there is less exudation of the blood plasm, and therefore less edema. Likewise, the contraction of the blood vessels will lessen the free bleeding from the severed vessels. He writes:

Cold compresses do not inhibit bacterial growth. Heat, in accelerating the circulation, produces an active hyperemia. It promotes phagocytosis by bringing to the affected parts a wealth of leukocytes. The lymphatic system also is stimulated, tissue drainage increasing.

When an infection has passed the stage of possible abortion (spontaneous resolution), the application of hot compresses will help the early localization of the abscess. Moist heat is preferable to dry heat for this purpose.

In analyzing the above, it would appear that cold therapy should be used in nonphlegmonous inflammation and that it should be applied before too much serous exudate has been poured into the tissues.

Heat should be applied in septic inflammations in order to promote phagocytosis and lymph drainage, with a hope of aborting the formation of an abscess. Likewise, heat should be applied in fulminating inflammation so as to bring about early localization of the infection.

The efficacy of hot and cold therapy lies in its scientific application. A hot water bottle or a steaming compress sufficiently hot to produce an erythema will do more harm to the tissues than good. Extreme cold applied over long periods of time will also produce serious tissue changes.

With regard to the relative influence of hot or cold compresses on postoperative hemorrhage, he believes that the pressure exerted is the most important factor in this therapy, notwithstanding the vasoconstrictor effect of the cold applications.

He says:

The predisposing factors in acute suppurative cellulitis and osteomyelitis are the virulency of the invading organism and the resistance of the host to the bacterial invasion. While it is true that bacteria thrive better in a warm environment than in a cold one, the fact that heat promotes phagocytosis and stimulates lymph drainage would indicate that heat should have a deterrent effect rather than being a predisposing factor.

Federspiel says:

The purpose of extra-oral application of heat is to localize infection. Cold is used to limit the rapid destruction of tissue from acute inflammation. I see no reason why any hot or cold compresses should be applied after an operation. If the work is done properly and the tissues are not traumatized, and the patient is put to bed and given a sedative, there is no reason why hot or cold compresses should be used. Cold, of course, may be used to prevent the development of edema.

Miller, from his observation of hospitalized patients, states that those to whom he applied immediate hot moist compresses had a more satisfactory and less eventful recovery than those who had an icebag applied. When excessive fluid exudates have accumulated to the extent of causing pain, ice was used in an effort to reduce swelling, but the cases wherein ice is used are rare in his practice. He points out the difference between the use of ice in soft tissue operations only, such as tonsillectomy, and the use of heat in bone involvements elsewhere in the body.

Engle uses cold compresses for the first ten hours, then heat, on the theory that, after contraction of the blood vessels and control of swelling, heat promotes circulation, preventing any infection from remaining localized. In osteomyelitis, he finds cold of no value, and when compresses are used, heat is his choice.

Bell uses heat when he "desires in-

crease in local activity" and cold when he "desires decrease in local activity."

Miner, in generalizing regarding the application of heat or cold, states that he makes use of cold for trauma liable to be followed by congestion; but when there is frank infection, applies heat "because more blood is brought to the part, which helps to overcome the activity of infection and destroy it."

Hatton, in classifying the sedative action of heat and cold, states that heat speeds up chemical, physiologic and inflammatory processes and tends to promote rather than decrease suppuration.

Heat relaxes, cold contracts muscles. Heat dilates blood vessels, especially arteries, and therefore tends to increase hemorrhage. Hence, it is a common cause of active hyperemia, as it brings more blood, oxygen, leukocytes, antibodies, etc., into the heated part. The increase in flow of blood through a part causes more rapid removal of waste products, carbon dioxide, etc. Cold retards chemical, physiologic and inflammatory processes and delays suppuration. Cold contracts blood vessels, especially arteries, and hence tends to inhibit hemorrhage and reduce the flow of blood through the cooled part, decreasing the supply of oxygen, leukocytes, antibodies, etc., and delaying the removal of waste products. Cold is frequently analgesic. As to suppuration, this may or may not be desirable. If inflammatory necrosis is present, certainly there is a no more rapid process of getting rid of the dead soft tissues than suppurative liquefaction and elimination of the pus by surgical drainage.

Blair[1] states that one of the oldest treatments for localized infection is heat:

> In general, it seems to promote comfort, allay pain and promote the circulation. In septic infection, it probably predisposes to suppuration; but in the presence of a septic infection of a certain virulency, local suppuration cannot be regarded as an evil. According to our present ideas, it is rather difficult to explain the good that undoubtedly results in many instances from the application of cold to an inflamed part. It cannot be the result of direct action of the cold on the infecting organisms, which are generally too deep-seated to be influenced by a direct cooling effect. Cold undoubtedly causes contraction of the blood vessels and lessening of the inflammatory reaction, and tends to prevent suppuration and allay pain. There are certain animal experiments that demonstrate the fact that reducing the temperature of the tissues reduces their resistance. We might conclude that, in all instances, the inflammatory reaction is excessive, and that cold in beneficial in regulating it.

Hatton, in commenting on these general virtues, takes exception to the last sentence. He suggests that this should read: "In all instances benefited by cold, it may be assumed that the inflammatory reaction is excessive and that cold is beneficial in regulating it." In this exception, I heartily concur.

Holman states definitely that he does not apply cold externally to any infections. Nature's method of combating infection is to increase the blood supply and temperature at the site of the infection.

> We believe in helping nature by applying heat to any infected region. . . . We believe that the application of cold is detrimental in the case of any infection, for several reasons. It promotes thrombosis within the vessels and therefore promotes stasis and stagnation of blood. . . . I would have no hesitancy in using hot compresses on a swollen jaw; but I should be very much opposed to the application of cold compresses, and it is my opinion that such cold compresses can be a factor in the development of cellulitis, although this is an impression and not scientifically proved.

Brown, in cases of infection and gen-

1. Blair, V. P.: Surgery and Diseases of Mouth and Jaws, Ed. 3, St. Louis: C. V. Mosby Co., 1918, p. 36.

eral phlegmonous conditions, prefers to use hot moist compresses, but calls attention to two important facts. He suggests the modification of treatment in very hot weather, because of the general discomfort of patients, calling attention to the fact that compresses of too high a temperature are detrimental, owing to the effect of excessive temperature on the capillaries. Cold he always uses in postoperative hemorrhage. As for the relative effect of heat or cold as a factor in postoperative infection, he always uses heat where the presence of infection is suspected.

Potts says, "I never use cold except on rare occasions, where heat is painful. Cold produces a passive hyperemia and I think active hyperemia is more beneficial." He uses moist compresses, kept hot by a light placed over them.

The opinion of Schultz, based upon fundamentals, seems a logical approach to this controversial question. He does not believe that the temperature change one way or the other has any significant direct effect on the organisms in the infected tissues.

Stomatophilic organisms grow best at body temperature and not so freely at temperatures falling somewhat short of the optimum in either direction. Differences sufficient to disturb the rate of multiplication of organisms, are not likely to be created by the use of compresses, on the basis of external temperature changes. The answer to this question must be sought on the host side of the battlefield. In the first place, one should bear in mind that inflammation is a purposeful physiologic response to an injury; a process in which the humoral and tissue defenses of the host are mobilized. This is accomplished by vasodilation associated with increased blood flow and lymph flow from the part, mobilization of phagocytic cells, etc. Therefore, in acute inflammation, the procedure should be to facilitate rather than hinder the mobilization of the host defenses by the application of heat to increase the local hyperemia, especially if the application is made intermittently. Therefore, heat should be applied to increase the physiologic processes associated with inflammation; cold, only to ease the pain, should the hyperemia and swelling become too marked for the patient to bear. All acute infections should be treated with hot applications rather than cold, even though the prolonged application of cold does eventually lead to vasodilation. Increased circulation is the objective in infections and this is obtained best by hot applications. . . . Apply heat in inflammations due to infection and cold to inflammation due to simple trauma, e.g., sprained ankle and bruises. Here, the temporary application of cold causes vasoconstriction and reduces swelling and is therefore analgesic.

Regarding the influence of temperature change in postoperative hemorrhage, there is doubt that the extra-oral application of either heat or cold affects hemorrhage in any marked degree. While the application of cold, theoretically at least, should contract the blood vessels, the application of heat tends to accelerate all the chemical reactions concerned with the coagulation of the blood.

I do not know why the immediate postextraction or postoperative application of hot or cold compresses should be a factor in acute suppurative cellulitis or a subsequent osteomyelitis. I do not believe that I would apply cold, but I do believe that the application of heat may prove helpful in forestalling infection. The question of postoperative infection is so involved that it is difficult to generalize. There are various other factors such as the relative virulence of the organisms which happen into the field, the general level of the resistance of the host and the amount of trauma inflicted, which seem to me of much greater importance.

McLean[2] believes that all types of edema or inflammatory exudate of the maxilla or the mandible should be

2. McLean, F. M.: Apollonian, 8 (Jan.) 1933.

handled as potential cases of deep cellular infections. "Scar formation on the face is not desirable but more acceptable than bone destruction and general sepsis." In the treatment of osteomyelitis, he believes that heat is indispensable; and he employs it to the exclusion of everything else. For inflammations of short duration, i.e., from one to three days, when there is but slight extravasation of fluid and a great deal of swelling, and the fluid is apparently not deeply seated, he finds cold applications to be helpful, while using hot intra-oral irrigation.

Austin[3] suggests that heat be applied in conditions that are phlegmonous or when cellulitis resulting from extraction of teeth is present. "Drainage in such cases is not good and heat helps to localize the condition."

Baer[4] has stated that, as a general rule, he prescribes external application of ice compresses, not only for the relief of pain, but also because the cold tends to lessen edema and allays inflammation, thereby reducing the heat necessary for proliferation of bacteria.

Gardner's[5] justification for the use of heat in preference to cold for control of hemorrhage is based upon the fact that the protein substance of blood coagulates at 120 F. Lowering temperature of the part prevents extravasation of the components of the blood and lymph. He advocates the use of cold applications in incipient swelling of an infectious source, in preference to heat. He writes:

From a strictly bacteriologic standpoint, the variance of temperature created by hot or cold surface application is of little consequence in inhibiting bacterial growth. If swelling and infection have become more extensive, heat, by means of hot compresses, is undoubtedly the choice. This is applied for the purpose of bringing about active hyperemia, and thereby increasing the number of leukocytes, hastening the formation of a leukocytic membrane and localizing the infection.

If this latter premise is valid for the more extensive infection, why should this treatment not be more beneficial in the case of the incipient swelling of infectious source, as a prophylactic measure?

Berger[6] believes cold to be especially indicated in early inflammatory conditions in the presence of active hyperemia and swelling due to exudative inflammation following trauma. Besides its constrictive effect on blood vessels, he credits to it the numbing or sedative effect. Preference for intermittent application is expressed in the opinion that it will prove more beneficial and prevent freezing of the part. He continues:

The processes of inflammation are in a large measure protective and defensive. Heat is more frequently indicated when there is stagnation and probably a deep-seated suppurative nidus. After free drainage is established, heat should be discontinued and moist, cold dressings will have a more beneficial influence.

This final use of cold is not generally conceded to be good surgical practice.

Podolin's[7] comprehensive discourse on cold and heat therapy definitely favors heat as an agent promoting physiologic defense. He points out the fallacious idea regarding the advantageous use of cold to inhibit the growth of bacteria as contrasted with the use of heat. Although he

3. Austin, L. T.: D. Cosmos, 64:1187 (Nov.) 1922.

4. Baer, Harry: Postoperative Treatment, J.A.D.A., 15:1653 (Sept.) 1928.

5. Gardner, B. S.; Stafne, E. C., and Wyckoff, B. S.: Preoperative and Postoperative Conditions Associated with Extraction of Teeth, J.A.D.A., 18:1601 (Sept.) 1931.

6. Berger, Adolph: Principles and Technique of Removal of Teeth; Post-Operative Pain, D. Items Int., 48:331 (May) 1926.

7. Podolin, Matthew: Cold and Heat Therapy in Dental Inflammations, J.A.D.A., 23:61 (Jan.) 1936.

acknowledges the possible beneficial action of cold in certain stages and types of inflammation, he expresses doubt as to whether even in these types heat would not be just as beneficial.

Mead[8] states that cold is indicated in the early stages of inflammation, but after the occurrence of exudation, it hinders the inflammatory process and prevents absorption, and hence should be used only in endeavoring to prevent inflammatory exudation. But he also states that cold applications should be used in the beginning stages of acute infection. This seems contrary to physiologic principles and has not a logical background. He advocates the use of cold applications up to twelve hours if swelling continues, alternating hot and cold beyond this time; finally, if swelling continues, using heat only. The reasons for using heat in the last instance are that it relaxes tissues and lessens tension, relieves pain, assists absorption in the presence of bacteria and hastens suppuration.

Wolf[9] describes the presence of hyperemia and edema as obvious impediments to local circulation. An increase in local arterial circulation followed by the application of local heat may lead to a more marked increase in edema and breaking down of tissues. This fact makes the actual temperature of a compress an important consideration.

Landis[10] has shown that the capillary pressure in the arterial limb in the skin of the finger is normally 32 mm. of mercury, and in the venous one, 12 mm., this pressure rising to 60 mm. and 45 mm., respectively, at a temperature of 42 C.

Drury and Jones[11] point out that edema is two to four times greater at 42 C. than at 16 C. Therefore, it may be expected that applications of extreme heat may have a deleterious effect on local circulation and therefore on local processes.

Starr,[12] from this observation, recommends the use of temperatures between 36.5 and 37.5 C. in applying wet dressings. The temperature of the skin covered by the wet dressings reaches about that degree, an optimum temperature for circulation to the affected part being created thereby. This procedure is predicated on the principle of maintaining an optimum temperature for regulation of circulation. We have still to explain the beneficial effect of using warm wet dressings on the surface in affecting the pathologic processes in the deeper tissues. Since we know that pathologic processes in deeper organs can produce hyperesthetic areas on the skin, we may be justified in assuming that a treatment employed to reduce these sensory disturbances to the skin may have a salutory effect on the deeper structure where they originate.

Heyman and Krebs[13] believe that, under the influence of wet dressings, the peripheral sensory nerve endings swell, and that, by the decrease of innervation stimuli, a relaxation is produced which proceeds from the periphery to the center. We, therefore, see two principles having a physiologic basis: the favorable effect on the local circulation and the relaxing influence on the nervous system, reducing

8. Mead, S. V.: Oral Surgery, St. Louis: C. V. Mosby Co., 1933, p. 994.

9. Wolf, H. r.: Physiological Basis of Wet Dressings, Arch. Phys. Ther. X-Ray Rad., 16:153 (March) 1935.

10. Landis, E. M.: Capillary Blood Pressure, Heart, 15:209 (May) 1930.

11. Drury, A. N., and Jones, N. W.: Observations upon Rate at Which Edema Forms When Veins of Human Limb Are Congested, Heart, 14:55 (April) 1927.

12. Starr, I., Jr.: Thermoregulated Foot Cradle for Treatment of Peripheral Vascular Diseases, Proc. Soc. Exper. Biol. & Med., 29: 166 (Nov.) 1931.

13. Heyman and Krebs, quoted in Winternitz: Hydrotherapy, Ed. 2, Leipsic: Urban und Schwartzenberg, 1890, p. 361.

the sensory impulses from the periphery and, hence, the irritation to the deeper structures.

Bazett[14] finds it impossible to consider the effects of heat and cold separately since the surface of the body has a variable temperature, and any given temperature may, under some environmental conditions, be classed as warm and others as cold. Heat and cold must therefore be considered together as positive and negative aspects of the same subjects. Many theories have been advanced regarding the effect of heat on the organism. Thomas Lewis, in a recent work, has shown that variations in temperature affect both vasomotor tone and reactions to stasis. He believes that the variations are dependent on a chemical change such as the production of a histamine-like substance. Other observers have demonstrated that temperature changes cause a definite alteration in the acid-base equilibrium of the blood.

The amount of topically applied heat necessary to produce a change in the temperature of deeper structures is dependent on the heat capacity of the tissues. Skin, fat and muscle all vary in their heat capacity and consequent conductivity. The heat capacity of tissue is high, one calory being required to raise the temperature of 1 gm. of tissue 0.8 C. (1.44 F.). While the vascular system plays a most important rôle in the conduction of heat to the deeper structures, variations in tissue temperature is always accompanied by vascular changes. The vascularity of a tissue must be taken into consideration in applying heat as the thermal therapeutic agent, as fat tissue and the dermis have a lesser heat capacity and serve as insulating tissues to the deeper structures. Low temperatures applied for a short time are not permanently injurious unless freezing has taken place. Temperatures considerably above freezing continued for long periods are capable of causing trench foot (observed in war) with edema, neuritis, urticarial reactions and hemoglobin urea (induced by exposures to temperatures of 18 C. [64.4 F.]).

The typical response to heat is vasodilatation; to cold, vasoconstriction. This change is partly due to a nervous reflex, although vascular changes can occur in denervated areas. Here, the changes, physical and chemical, must be directly on the blood vessels themselves. In temperatures below 18, dilatation has been observed in the skin of the extremities, although vasoconstriction persists in deep structures. Hewlett, Drury, Jones and others, in their work on temperature effects on local circulation rate, show that an increase in surface temperature from 26 C. (78.8 F.) to 42 C. (107.6 F.) or 46 C. (114.8 F.) increased the rate of blood flow five to six times. A decrease in surface temperature below 18 C. (64.4 F.) increases the flow in the superficial skin vessels, as demonstrated by Lewis and Landis, but these increases are overbalanced by decreases in the flow in deeper areas.

PHAGOCYTOSIS

The activity of the leukocytes in phagocytosis is modified by temperature. Phagocytosis has been described as being maximal at the normal temperature level of the individual, but, with fever, the optimal temperature is found to be the febrile level. Phagocytosis is impeded by local cooling.

Metabolism is affected by temperature changes, cold having a deleterious effect, as can readily be observed by cyanosis on exposure to low temperature. An impediment to metabolism often effects tissue change, and muscle activity is slowed

14. Bazett, H. C.: Principles and Practice of Physical Therapy, Vol. 1, Chap. 4, Hagerstown, Md.: W. F. Prior Co., 1934.

down by exposure to cold. The warming up of athletes is evidence of this fact.

When using heat in inflammatory conditions, we must remember that vasodilatation increases fluid exudation, so that, under certain circumstances, heat may appear to be contraindicated, particularly when exudation will interfere with blood flow. If the rate of blood flow is the most important factor, moderate cold with vasoconstriction and a decrease in capillary pressure might produce more rapid blood flow than vasodilatation with fluid exudation and consequent venous congestion. Thus, the beneficial use of ice packs might be explained, and certain cases might be selected on which to use cold. In any case except when the abovementioned conditions are increased, the use of cold is contraindicated, since the physiologic processes of immunity and phagocytosis are slowed. Even when edema is very evident, cold may not be beneficial. Filhene, 1894, during his work on erysipelas, found cold applications of doubtful value; while the mortality rate was lowered and more rapid convalescence obtained with warm applications even though the local lesions were more acute and angry in appearance. Some general statements with regard to the absorption of substances used on hot compresses may be appropriate at this time. This alone is an exhaustive subject. According to Eulenburg,[15] the uninjured human epidermis, except for possible absorption through the cutaneous glands, is entirely impermeable to fluids and to solids, or to substances dissolved in fluids which do not act mechanically or chemically on the horny layers on the cuticle. Although there have been many controversial statements with regard to absorption through the uninjured and unaltered epidermis, that absorption takes place has by no means been actually proved. All of the absorption of fluid and solid substances that takes place through an uninjured epidermis seems to be accomplished entirely through the cutaneous glands, and this, of course, is influenced by the action of the substance in solution on the obstructing materials in the dermis and by the change in temperature.

Kahlenberg[16] has demonstrated the passage of boric acid through the skin by osmosis. The protective function of the skin makes it particularly resistant to penetration of medicaments. Covered with a layer of dead keratinized cells and coated with a fatty substance, the sebum, the skin obviously affords protection against aqueous solutions of nonvolatile substances.

Maceration of the skin naturally favors absorption. The dryer the skin, the less penetrable it is.

Fantus[17] suggests that softening of the layers of the epidermis increases the size of the interstices between the cells. The use of moist hot compresses for long periods of time favors this process.

Sollman,[18] who experimented with numerous substances, has paid no little attention to the magnesium compounds. The recent work of Gammon and others[19] describes the beneficial effect of the counterirritation produced by cold on surface pain; but this he attributes to the

15. Eulenburg: Handbook of General Therapeutics, Vol. 2: Epidermic, Endermic and Hypodermic Administrations of Medicines, New York: Wood and Co., 1885.

16. Kahlenberg, Louis: J. Biol. Chem., 62: 149 (Nov.) 1924.

17. Fantus, Bernard: Technique of Medication, Chicago: American Medical Association, 1926.

18. Sollman, Torald: Manuel of Pharmacology, Ed. 4, Philadelphia: W. B. Saunders Co., 1932, p. 76.

19. Gammon, G. D.: Proc. A. M. Phy. Soc., 1936, p. 56. Starr, I., and Bronk, D. W.: Effect of Counterirritations upon Pain Produced by Cutaneous Injury.

effect on the cutaneous nerves through circulatory changes, produced by alteration in temperature, and the effect of blood flow on local concentration of the products of injury, which set up pain impulses and cause swelling of tissue.

The intermittent use of heat and cold seems a meaningless gesture based upon nothing that is fundamental or physiologically sound. In a series of cases tested for the actual practical effect of chilling a local region by using an ordinary icebag, a surprising result was obtained. A clinical thermometer was placed in the vestibule of the mouth in the molar region with the lips closed, and the temperature taken, after which the thermometer was withdrawn. An icebag was then applied to the same side of the face for ten minutes, and a second temperature reading taken. The average drop in temperature of the buccal cavity was three degrees. It is difficult to disregard the importance of this simple experiment in view of the facts at hand in regard to the effect of cold on all the vital physiologic processes of defense and regeneration. The effects on tissue temperature of prolonged use of an ice bag surely must be obvious.

On analysis of the various opinions regarding, and methods of application of, the two thermal agents, heat and cold, as used in the practice of oral surgery, the preponderance of evidence seems to favor the use of heat as a physiologic agent.

The merits of cold appear to be limited to early inflammatory stages, as an impediment to the effects of trauma or up to the point of clinical evidence of exudation; beyond which process a decrease in temperature has a deleterious effect. The deviation from the optimum temperature necessary to materially inhibit or destroy bacterial growth is so far beyond the safe physiologic limits for tissue that it can hardly be considered. Any significant impediment to bacterial growth must necessarily be influenced primarily by the physiologic defenses. Although some believe in the bacteriostatic influence of cold compresses, we still see, when potential infection exists, the overbalancing belief in maintaining and promoting normal inflammatory processes by use of heat. It is therefore my belief that ice cannot be used with impunity.*

*The following are quoted by the author as responding to a questionnaire regarding the comparative advantages of the therapeutic use of heat and cold: J. H. Johnson, associate in dental surgery and anesthesia, University of Toronto; Bernard G. Wakefield, Department of Oral Surgery, University of Buffalo, School of Dentistry; J. W. Gerrie, Oral Surgery Department, McGill University, Montreal; Irwin T. Hyatt, associate professor of oral surgery and anesthesia, Atlanta-Southern Dental College; E. F. Tholen, Department of Oral Surgery, University of Southern California; C. D. Gwinn, Department of Oral Surgery, University of California, College of Dentistry; Frederick F. Molt, Chicago, Ill.; S. B. Fontaine, professor of oral surgery, College of Physicians and Surgeons, A School of Dentistry; Matthew N. Federspiel, Marquette University Dental School; H. C. Miller, Chicago, Ill.; A. C. Engle, Department of Oral Surgery, St. Louis University School of Dentistry; Weldon B. Bell, Department of Oral Surgery, Baylor University, College of Dentistry; Leroy M. S. Miner, professor of oral surgery, Harvard University Dental School; E. H. Hatton, professor of pathology and bacteriology, Northwestern University Dental School; E. F. Holman, professor of surgery, Stanford University, Medical School; J. B. Brown, associate of V. P. Blair, St. Louis, Mo.; H. A. Potts, professor of oral surgery, Northwestern University Dental School; E. W. Schultz, professor of bacteriology and experimental pathology, Stanford University Medical School.

DIET IN RELATION TO GINGIVITIS: FIELD OBSERVATIONS IN NEW GUINEA*

By R. M. KIRKPATRICK,† B.D.S., D.D.Sc., Sydney, Australia

TWO hundred miles northwest of the mainland of New Guinea lies Manus, an island about 90 miles long and 35 miles wide and having a native population (Melanesians) of about 15,000.

I was afforded the opportunity to accompany to this island F. W. Clements, of the School of Public Health and Tropical Medicine, who was making an effort to determine the etiology of tropical ulcer.

The diet of the natives on this island varies in different districts, but each type of diet is comparatively simple as compared with the diets of civilization.

The main variation of food in the different districts consists in the presence of either taro or sago in the diet. Seldom are the two carbohydrates eaten in the same district.

Taro is the bulb of a lily-like plant of the cassava family. Sago is obtained from the pulp of the stem of the sago palm. It is not to be confused with domestic sago, which is manufactured from manioc.

An itinerary along the coast and through the inland districts was planned so that examination could be made of the natives in the taro and in the sago districts.

To avoid examination of selected groups, word was always sent forward to each village the day before so that all the inhabitants would be present for inspection.

The following observations were recorded: sex, age, condition of the teeth,[1] formation of the arches, and, especially, the condition of the gingivae, as to (*a*) gingivitis in all its forms, (*b*) recession of the gingival attachment, (*c*) suppurative periodontitis and (*d*) the presence of tartar and other oral abnormalities.

Those villages in which the natives lived mainly on sago were classed together, as were the villages where the natives depended on taro for their main sustenance. The natives were closely questioned concerning their foods and the weights of the constituents of average meals obtained.

The ratio of animal or fish protein to the carbohydrates in the diet varied somewhat, as would be expected, but, on the average, there was a marked imbalance toward an excess of carbohydrate.

Either taro or sago is eaten twice a day, as a rule, and is frequently supplemented at least once a day with some fish or opossum. Even then, the weight of protein is only about one twenty-eighth that of carbohydrate.

As far as possible, samples of the prin-

*Work carried out by the author while holding the Australian Dental Association (New South Wales Branch) and Walter and Eliza Hall Dental Research Scholarship.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 14, 1936.

†Dental Research Scholar of the University of Sydney.

1. Kirkpatrick, R. M.: D. J. Australia, 7: 707 (Nov.) 1935.

cipal foods were obtained, preserved and sent to the School of Public Health and Tropical Medicine, Sydney University, for analysis.

Two complicating factors of the oral investigation were the presence of calculus, arising from the chewing of betel nut, and the effect of smoking. As far as could be observed, these habits were indulged in to the same extent by the various age groups of natives throughout the island.

Fig. 1.—Native taro garden.

Fig. 2.—Taro plant, a tuber belonging to lily family.

On the coast, the natives spend their time fishing. They barter for sago or taro with the inland natives, who exchange these products for fish. In those districts which are suitable for the cultivation of taro, the natives are fully occupied with its production and do not bother about "working" sago, since the sago palm grows mainly in swampy country, which is occupied by less fortunate natives. It seems unusual that the natives do not tire of the one carbohy-

Fig. 3.—Sago palm. The stem is about 25 feet high.

Fig. 4.—Taro ready to be steamed.

drate. Sago is relished as a food just as much as taro, and where the one is plentiful, the other is not gathered for food. Those villages which are too far from the coast to barter for fish depend for their animal proteins on opossums and marmots.

Other foods, which are eaten in very scanty quantity, are (*a*) fruits, such as paw-paws, bananas, lemons, and soursaps, (*b*) betel nut with daka leaf, and

Fig. 5.—Preparing sago palm for food. The stem is split open and the pulp is pounded into small fragments.

sugar cane and (*c*) pig (at festival time.) The consumption of all these articles of diet is more or less universal, even though the supply is very limited.

For periods of months on end during certain monsoonal seasons, when no fish can be caught, the food supply is restricted to the staple foods, such as sago or taro.

Taro is dug up and its roots cut off, scraped a little and then steamed. It forms a sticky glutinous mass which, when cool, is picked up and eaten as one would eat an apple. Its composition as estimated at the School of Public Health and Tropical Medicine, Sydney, is as follows:

TABLE 1.—ANALYSIS OF STEAMED TARO

Water	63.600
Protein	1.700
Fat	0.410
Ash	0.940
Phosphorus (P_2O_5)	0.119
Calcium (CaO)	0.032
Starch and sugar	33.199
	100.000

The vitamin content of taro has been

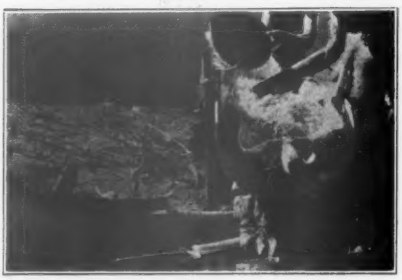


Fig. 6.—Preparing sago for food. The comminuted pulp is carried to a washing, filtering and sedimentation apparatus (all made from parts of the palm), where the coarse fibers are filtered away from the finer particles.

estimated at the Bernice P. Bishop Museum, Honolulu, as "twice as much vitamin A as white potatoes, and as much as cabbage," the vitamin B content being "half that of whole grain (including embryo), and twice as much as milk."

This means that taro is rich in vitamin A and fairly so in vitamin B.

Sago is obtained by pounding up the pulp of the stem of the sago palm, washing and straining the fiber so obtained and collecting the sediment, which is

dried, wrapped in green palm leaves and stored away.

Sago consists essentially of starch. Its occurrence in the stem of the palm rather precludes any possibility of its containing vitamins, since in plant life, vitamins are usually confined to the germinating centers and leaves.

The composition, on analysis at the School of Public Health and Tropical Medicine, Sydney,[2] was found to be protein, 1.2 per cent, fat, 0.6 per cent, and carbohydrate, 83.5 per cent. The biologic test for vitamins failed to reveal measurable quantities.

Fig. 7.—Preparing sago for food. The filtrate, collected in a reservoir, is allowed to settle and the supernatant liquid is decanted off.

Natives living on a sago diet consume from 1½ to 2 ounces of meat or fish to every 28 to 30 ounces of sago at a meal. As there are two meals a day, from 3 to 4 ounces of meat is consumed, with from 56 to 60 ounces of sago. If we assume that 33 per cent of the weight of dried fish or meat is protein, the protein:sago ratio would be approximately 1:56. As dried sago is about half the weight of prepared sago, the protein:carbohydrate ratio would be 1:28. The amount of fat consumed is about the same as the amount of protein, the protein:fat:carbohydrate ratio being 1:1:28 or 100:100:2,800. A committee of the Royal Society has laid down as a proper diet for an average man the following ratio: protein:fat:carbohydrate::100:100:500.

Fig. 8.—Preparing sago for food. The collected sediment (sago) is dried, tightly wrapped in leaves and stored away. When needed, it is mixed with about one sixth of its weight in ground-up cocoanut and cooked, while constantly being mixed, over a fire. When it is cool enough, a handful is compressed into a lump and placed in the mouth.

Since taro contains some protein, the ratio would be a little more favorable for those natives living on it, but, even so, it may be safely estimated that all the natives eat at lease five times more carbohydrate in proportion to protein than they should.

A comparison of the two types of car-

2. Clements, F. W.: Relation of Diet to Tropical Ulcer: Preliminary Report, M. J. Australia, 520 (April 21) 1934.

bohydrate diet of the islanders shows that although both are badly balanced because of a deficiency of protein, the one of which taro forms the basis contains, among other vitamins, a sufficiency of vitamins A and B; whereas, the other, in which sago forms the basis, appears to be

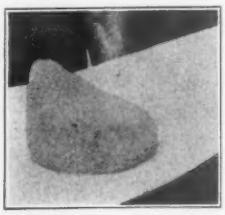


Fig. 9.—Lump of sago.

Fig. 10.—Breaking up sago.

Fig. 11.—Ground cocoanut, which is mixed with sago in the proportion of 1 to 5.

lacking in vitamins A and B, except for that contained in the ground-up cocoanut eaten with the sago, along with a very scanty amount contained in other foods occasionally eaten. As the cocoanut constitutes only about one sixth of the total amount of the sago, the sago diet must be considered to contain an insufficient amount of vitamins.

Among other sources, vitamin C is obtained from pepper leaf, which is very

Fig. 12.—Sago and cocoanut stirred together and roasted over fire.

Fig. 13.—Native manner of eating sago mixture.

rich in the vitamin, and is eaten with betel nut.

Mineral salts are supplied in sufficient amounts in the fish or flesh eaten, and in the calcined coral which is chewed with the betel nut.

TABLE 3.—ORAL CONDITIONS PERTAINING TO THE GINGIVAE

Diet	Total Number	Number and Percentage of Cases Presenting						
		Recession of Gingival Attachment	Crowding of Teeth	Traumatic Occlusion	Calculus Formation	Chronic Gingivitis	Acute or Subacute Vincent's Infection	Suppurative Periodontitis
Sago	1020	290 (28.43%)	236 (23.14%)	47 (4.61%)	222 (21.67%)	221 (21.67%)	52 (5.10%)	278 (27.25%)
Taro	956	255 (26.67%)	160 (16.74%)	8 (0.84%)	183 (19.14%)	236 (24.69%)	14 (1.46%)	145 (15.17%)
Significant difference		No	Yes	Yes	No	No	Yes	Yes

TABLE 2.—ANALYSIS OF CALCINED CORAL

Calcium oxide (CaO)	62.28
Phosphorus (P_2O_5)	0.56
Carbon dioxide (CO_2)	20.90
Water	16.26
	100.00

The significant difference between the two types of diet appears to lie in the different vitamin content of taro and sago. This does not mean to imply that the natives living on sago do not get any vitamins similar to those obtained by natives living on taro, but rather that the amount of vitamins they consume is deficient when compared with the amount ingested by the natives living on taro.

Table 3 shows the occurrence, in persons examined during the investigation, of the oral conditions pertaining to the gingivae; in absolute numbers and in percentages.

Of the 15,000 natives living on the island of Manus, about 2,000 were examined. As nearly as possible, such villages as offered average conditions of living and an equal number of taro and sago eating natives were visited. Accordingly, some villages on each of the coasts and inland were inspected. It is, therefore, thought that the natives who were examined are a good sample of the total population. Particular care was taken to examine every native who lived in each village visited so that a selected grouping would not enter into the problem.

On the evidence obtained, it may be taken that the percentages stated in the table suggest the probability that each of the conditions mentioned occur in all the natives throughout the island.

The results have been tabulated in two main groups: those cases in which taro was the staple diet, and those in which sago was the chief article of diet.

If the statistical test suggested by

Pearl[3] for similar tables is applied to the distribution of malconditions of the gums in the sago and taro eating natives, it is found that the distributions are significantly different because such an occurrence would happen fewer times than 1 in 1,000,000 by chance alone.

The most apparent differences are in the incidence of crowding of the teeth, traumatic occlusion, acute or subacute Vincent's infection and suppurative periodontitis. The occurrence of each of these conditions is significantly different in the taro-eating and the sago-eating natives.

Crowding of the teeth and traumatic occlusion are conditions which may cause a predisposition to any gingival disturbance, and the higher incidence of these phenomena may be due, in part at least, to the different consistency of taro and sago and the manner in which they are eaten. Taro has approximately the consistency of a firm pear and is held in the hand and eaten as a piece of fruit would be, the incisor teeth being exercised and the gingivae stimulated each time a bite is taken. Sago, which is prepared in such a way that it consists of very small particles, is placed in the mouth by the hand as one would place a heap of bread crumbs, there being no resulting incisal action of the anterior teeth. Perhaps this may seem a minor point, but when it is remembered that the major function of the incisor teeth is to incise and bite into food, the importance of this exercise must be realized.

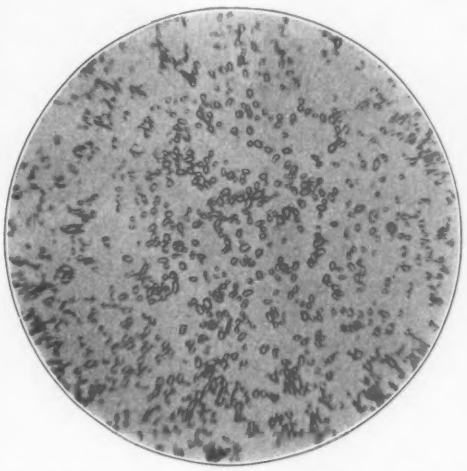


Fig. 14.—Granules of sago, which resemble those of starch. (Approximately ×100.)

Although sago, which is mixed with a little ground-up cocoanut during its preparation, prior to roasting, is of comparatively fine comminution when placed in the mouth for mastication, it is, because of the cocoanut present, tough and fibrous, and requires a side-to-side masticatory movement for its further comminution prior to swallowing. Taro, on the other hand, is not tough and requires

3. Pearl, R.: Introduction to Medical Biometry and Statistics, Ed. 2, Philadelphia: W. B. Saunders Co., 1930, p. 322.

only a more or less up-and-down crushing movement of the teeth for its mastication prior to deglutition. Pickerill[4] (1923), has shown that a coarse diet, requiring the excessive use of the internal pterygoid and mylohyoid muscles early in life, causes narrowing of the arch and crowding of the anterior teeth. This probably explains the greater incidence of crowding in the sago-eating than the taro-eating native.

Fig. 15.—Typical mouth, showing normal healthy gums.

Fig. 16.—Crowding of teeth and traumatic occlusion, with slight gingivitis.

Crowding of the teeth and traumatic occlusion are often closely related, the latter usually being the result of such crowding. Especially, as is the case with these natives, traumatic occlusion is in almost every case present only in the anterior teeth where crowding occurs. At the same time, it must be remembered that traumatic occlusion, even with a crowded arch, cannot be present if a sufficient amount of wear has occurred.

As regards traumatic occlusion, especially in the older natives, the complicating factor of betel-nut chewing arises. In

Fig. 17.—Malocclusion.

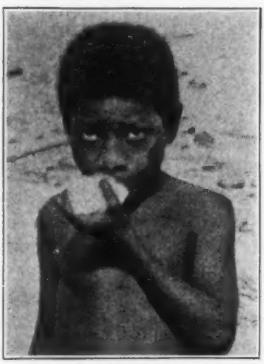


Fig. 18.—Manner of eating taro, which is held and bitten into as is an apple.

certain of these cases, traumatic occlusion of the anterior teeth occurs even though these teeth are regular. The reason for the occurrence of such traumatic occlusion is that lime (calcined coral) is placed, by means of a spatula, on the occlusal

4. Pickerill, H. P.: Prevention of Dental Caries and Oral Sepsis, Ed. 3, London: Bailliere, Tindall and Cox, 1923, p. 43.

surfaces of only the molar and premolar teeth while the betel-nut is being chewed. The lime is used to neutralize the acidity of the nut juices, but it is an abrasive and wears the posterior teeth down, the anterior teeth being left comparatively long so that they clash during mastication and cause occlusal trauma.

Fig. 19.—Manner of eating sago, which is placed in mouth like heap of bread crumbs and therefore does not require biting.

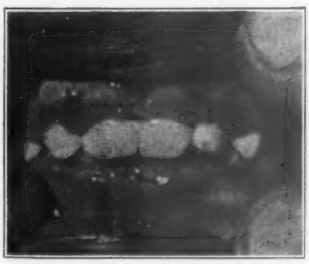


Fig. 20.—Acute Vincent's infection around deciduous incisors. The interdental papilla of gum between the upper central incisors is necrotic.

It is noticed that, in both groups, there is a high incidence of chronic gingivitis, although the difference is not significant. Several hundred smears were made from the gum margins in these cases, and the fusospirochetal organisms were invariably found, although there was no evidence that acute Vincent's infection had ever occurred. It is almost certain that these cases of gingivitis are the source of the

Fig. 21.—Subacute Vincent's infection around upper incisors.

Fig. 22.—Crowding of teeth. This condition is seldom marked in the deciduous teeth, but, at this child's age, the upper teeth should have separated to allow room for the larger permanent teeth. Crowding of the lower permanent teeth may be noted.

Fig. 23.—Chronic Vincent's infection, with hypertrophy of gingival margins.

organisms that accompany and probably are responsible for acute Vincent's infec-

tion when the dietetic and local conditions are such that tissue resistance is lowered.

From Table 3, it will be noted that there is a far greater incidence of acute or subacute Vincent's infection in the sago-eating natives than in the others. The significant variation in the occurrence of the infection cannot be fully explained by the different physical structure of the foods, because cure of the infection is said by Dr. Strong, principal medical officer, Papua, to be effected by the administration of large doses of orange or other fruit juices,[5] and therefore some dietetic deficiency is probably present. Its sporadic occurrence in isolated areas indicates that it may be due to a constitutional disturbance, which is probably dietetic in origin. I do not know of any other changing influence that can be correlated with the infection. The supposed organisms are present in quite a high percentage of mouths, and apparently await a favorable opportunity for invasion when a dietetic insufficiency occurs that is of sufficient gravity, under the circumstances, to reduce the resistance of the periodontal tissues.

STATISTICAL ANALYSIS OF TABLE 3

The tests of significance between two different proportions have been calculated according to suitable formulae given by Yule.[6] When a difference between two proportions has been three times its own standard deviation, it has been considered significant.

1. Recession of gingival attachment: The difference between the percentages is 1.66 per cent, which is 0.83 times the standard deviation of the difference, and therefore is not significantly different. Such a different percentage could have occurred from errors of simple sampling.

2. Crowding of teeth: The difference between the percentages is 6.4 per cent, which is 3.55 times its standard deviation, and therefore significant.

3. Traumatic occlusion: The difference between the percentages is 3.77 per cent, which is 5.09 times its standard deviation, and therefore significant.

4. Calculus formation: The difference between the percentages is 2.62 per cent, which is 1.44 times its standard deviation, and therefore not significant.

5. Chronic gingivitis: The difference between the percentages is 3.02 per cent, which is 1.59 times its standard deviation, and therefore not significant.

6. Acute or subacute Vincent's infection: The difference between the percentages is 3.64 per cent, which is 4.50 times its standard deviation, and therefore significant.

7. Suppurative periodontitis: The difference between the percentages is 12.08 per cent, which is 6.54 times its standard deviation, and therefore significant.

SUMMARY AND CONCLUSIONS

In a statistical survey of the oral conditions of the natives (Melanesians) on the island of Manus, New Guinea, it was found that those living principally on taro had better developed dental arches and showed a smaller incidence of acute or subacute Vincent's infection of the gingivae than the natives living mainly on sago.

It is suggested that the lack of essential food constituents in the sago diet may be partly responsible for the predisposition of the gingivae of these people to severe fusospirochetal infections.

5. Personal communication to the author.

6. Yule, G. U.: Introduction to Theory of Statistics, Ed. 7, London: Charles Griffin and Co., Ltd., p. 268.

MASTICATORY EFFICIENCY AS RELATED TO CUSP FORM IN DENTURE PROSTHESIS*

By MORRIS J. THOMPSON, D.D.S., Los Angeles, Calif.

MANY teeth of various form, type and shape have been suggested as a means of restoration to functional satisfaction of edentulous patients, but little or nothing of value has been done to evaluate chewing efficiency. Efficient mastication should be the essential reason for restoring the masticatory organ. It is the prime consideration in truly scientific denture service.

The average practitioner of today is quite aware of the inadequate denture service offered patients and is ready to accept information that is scientific if it will tend to improve mastication.

The medical and dental professions and the laity agree quite readily that food should be chewed thoroughly before deglutition—an assumption based on the fact that Nature provides us with teeth. Although it is generally conceded that an absence of teeth and ill-function of artificial dentures have an injurious effect on health, little has been done to show the salutary effect of efficient mastication on digestion.

Let us agree at the outset that efficient mastication is chewing to a degree of fineness that will facilitate the function of the digestive organs.

Many opinions and theories have been written on the subject by men of the United States and Europe. The most scientific work has been done by K. Seppae,[1] a German, S. E. Gelman,[2] of Russia, and M. Hara,[3] of Japan. D'Alise,[4] Schultz[5] and Paulsen,[5] also, have contributed to this subject.

Dr. Gelman made an extensive and elaborate investigation relative to the influence of mastication of cooked foods on digestion. He developed a method of determining the chewing capacity, or efficiency, and a technic for testing the ability of a person to digest food.

In his tests, the chewing capacity of each person and the amount of the food to be eaten was known. Sufficient food was selected to make a definite number of tests for thirty-one clinically healthy people of different ages.

The food used for the tests was rice, which was eaten with bouillon and meat taken from soup; butter, which was eaten on bread; and sweetened tea, which was taken with the meal. He had several of the same people chew the cooked food efficiently and inefficiently. The results

*Read before the Section on Full Denture Prosthesis at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 15, 1936.

1. Seppae, Kettu: Zur Kenntnis der Bedeutung des kauens für die Resorption, Skand. Arch. f. Physiol., 57:159-242 (July) 1929.

2. Gelman, S. E.: Die Bedeutung des Kauaktes für die Verdauung, Ztschr. f. Stomatol., 31:1220-1232 (Oct. 13) 1933.

3. Hara, M.: Relationship Between Mastication and Digesion and Absorption, Shokugo, 2-3:129-144, 1930; 4-1:18-30, 1932.

4. D'Alise, C.: Dental Prosthesis in Treatment of Digestive Disturbances, Riforma med., 42:324-325 (April 5) 1926.

5. Quoted by Seppae, Footnote 1.

showed that the increase in digestion with the well chewed food was from 0.3 to 2.7 per cent. In his conclusions, Dr. Gelman states, "The pathology of mastication is not clearly established within the general pathology of the gastro-intestinal canal; it still needs a further conscientious study with a greater number of concrete cases on the pathology of the gastro-intestinal canal."

Kettu Seppae obtained results similar

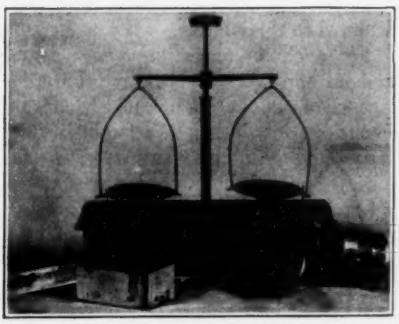


Fig. 1.—Equipment used. Right, masticatory gage; left, box for cutting food; center, scale.

Fig. 2.—Maxillary impression and central bearing unit attached to mandibular vulcanite tray.

to those of Dr. Gelman. The improved digestion, due mostly to better mastication, showed an increase of 0.5 to 1.9 per cent, and, let us remember, this experiment was conducted with cooked foods and smoked bacon. Dr. Seppae, in his summary, states, "These results rest upon the experiments made upon good healthy people, and do not eliminate the possibility that poor chewing in connection with certain pathologic changes in the activity of the stomach and intestines may not lead to a decrease in the absorption and in time may lead to definite pathologic conditions."

Dr. Hara, in his investigation, employed uncooked food as well as cooked foods. His results indicated that efficient mastication improves digestion. The increase in digestion and absorption was from 1 to 40 per cent.[6] It appears, from

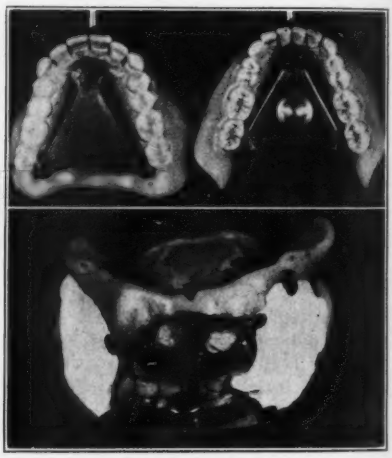


Fig. 3.—Apparatus used for registering mandibular movements in final refinements of denture balance; illustrating the manner in which central bearing unit and projected tracing device are attached to dentures, also plaster checkbites in place for lateral interarch relation.

the results of Dr. Hara, that the difference in results lies in the texture of the food, or in breaking down the fibrous substance that resists digestion.

A more accurate cross-section of the

6. Okumura, Tsurukichi: Some Phases of Recent Development of Dental Hygiene in Japan, J.A.D.A., 21:1279 (July) 1934.

effect of mastication on digestion might have been obtained if Drs. Gelman and Seppae had included a greater number of foods of everyday use.

It appears reasonable that raw food, such as lettuce, carrots, cabbage and celery, and other foods that make up present-day salads would show an improvement in digestion if the raw substances were better chewed. The diet selected by Drs. Gelman and Seppae ordinarily would be the choice of a person who could not chew well or who was convalescing in a hospital. Nevertheless, this fact should not detract from the value of the scientific research of Drs. Gelman and Seppae on cooked foods. The work of these two men should not lessen the interest of prosthetic investigators who are genuinely interested in chewing efficiency of artificial teeth, especially for raw and fibrous foods.

Ingestion of food that has not been finely ground up by the teeth will increase the labor of the stomach, according to the

Fig. 4.—Dentures described as Case 1 *b*. Left, side used for the chewing tests. These dentures have good stability, but do not have a good balance or carved chewing surfaces.

Fig. 5.—Case 1 *d*. The supplemental grooves of the lower teeth were carved and stained before completion of the case. The grooves of the maxillary teeth were darkened for photographing to bring out the supplemental ridges. The teeth to the left were used in making tests with Case 1 *d*. The teeth to the right compare very favorably with those of the left side before the supplemental grooves were carved with stones. The uncarved teeth were described as Case 1 *c*.

report of L. Von Friederick's[7] extensive research on the influence of chewing on the mobility of the stomach.

Other than the research by Gelman, Seppae and Hara, little scientific attention has been given the physiologic function of the mouth. For the past eighty-five years, a great deal of time and effort has been expended by the prosthetists in designing and constructing articulators and accessory instruments. Instruments have been made and technics of varied descriptions have been advocated as the last word in the restoration of masticatory function with artificial teeth. Yet, as far as my investigation goes, no scientific means is in use to measure efficiency. The only information of value has been gleaned from the patient.

Today, the trend of constructive thought appears to be centered around the nonanatomic tooth. This may be due to the eagerness of the average practitioner to find a better and more satisfactory procedure for treating the edentulous patient. The nonanatomic tooth is not new, but interest in it has been revived since the innovation of the Hall cuspless tooth.

Many dentists use the cuspless tooth because, in their opinion, the dentures are less likely to cause the patient discomfort while chewing, and also because the technic of articulating the teeth is much easier. Some of the leaders in the prosthetic field advocate and use the cuspless tooth and other nonanatomic teeth because they believe such teeth produce less lateral pressure upon the alveolar ridges and that the bony structures maintain the same contour and height under the base of the dentures over a longer period of time.

Use of the cuspless tooth is quite often criticized because of the radical change in design and its inefficiency as compared to the anatomic porcelain tooth. This adverse attitude may be justified, as no one, to my knowledge, has shown, in a strictly scientific manner, the superiority of the cuspless tooth for restoring masticatory function.

Unfavorable criticism may be justly or unjustly voiced against the anatomic tooth for use in full dentures, because no convincing evidence of any consequence has been produced to show the superiority of this tooth for restoring masticatory function.

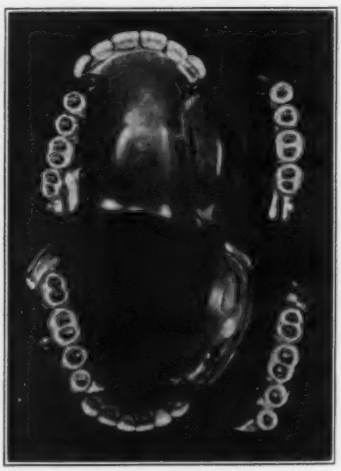


Fig. 6.—Specially designed dentures for experimental work. The posterior teeth are removable and can be accurately reseated and held securely with screws.

Demonstrated through the courtesy of sympathetic patients, artificial dentures that reflect a great deal of skill have been exhibited at dental meetings, but insufficient proof, as far as I can learn, has been given that these anatomic teeth will masticate with efficiency and satisfaction. In many instances, the anatomic markings

7. Von Friederick, L.: Kauakt und Magenfunktion, Arch. f. Verdauungskr, 43:140-149 (March) 1928.

that should facilitate chewing have been sacrificed by the operator in order to demonstrate a perfect cuspal coordination and denture balance.

No doubt, well-balanced dentures will give comfort and a sense of stability when the patient is not chewing food, but from the experience which I have had while making the comparative chewing tests (with both anatomic and nonanatomic teeth, and which I will speak of later in this paper), teeth with poorly carved occlusal surfaces will not give the patient satisfaction and ease of mastication or provide maximum chewing efficiency.

Ever since the cuspless tooth claimed more than passing attention of the profession, I have been interested in learning the maximum chewing efficiency of artificial dentures constructed on favorable and unfavorable edentulous arches.

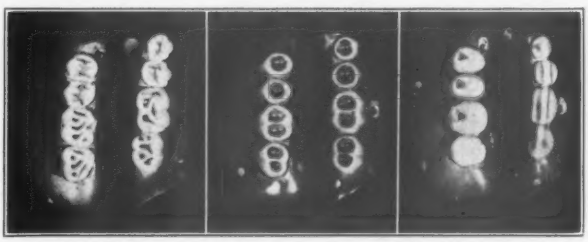


Fig. 7.—Left, Case 2, efficiency, 57 per cent; center, Case 3, efficiency, 58 per cent; right, Case 4, efficiency, 29 per cent; three different cusp forms of removable blocks of teeth tested on specially constructed denture bases. Case 2 was made with 20 degree posterior teeth, Case 3 with the Hall inverted cusp teeth and Case 4 with the Sears channel teeth.

After some planning, the work of making tests with one patient as to the fineness of food chewed with artificial teeth was initiated. The experiments were made with dentures constructed of teeth having distinctly different cusp forms. The sets of teeth were tested under various conditions, degrees of balance and occlusal markings.

The mouth presented ridges that should be considered favorable for supporting dentures. The problems of conducting tests with the uncertainty of the human element intruding were many. Few factors were constant in the process, although a great deal of effort was used to make the tests under like conditions and to eliminate gross errors. The shortcomings of the testing process have necessitated concentrated thought in order to attain a more scientific method. With further development, the inaccuracies should be reduced to a minimum. Food as a material for the tests was the greatest problem because the texture varied if the food was selected or acquired at different times. This too can be rendered a simple problem with additional study.

After the work had progressed for some time, and many raw foods had been used, it appeared that raw Irish potato was the most satisfactory material for the tests. It was used exclusively in the recent work.

A large potato provided enough material to make a great many tests, and could be kept on ice for a long time with a minimum of change in texture. It did not clog or collect in the supplemental grooves or fossae as almonds, hazel nuts and peanuts did. The potato was ground fairly clean and the comminuted particles

TABLE 1.—TESTS WITH CASE 1 A*

Mesh	Carrots			Lettuce			Cabbage			Ham			Celery			Apples		
	Grains	Retained in Mesh Per Cent	Chewing Efficiency Per Cent	Grains	Retained in Mesh Per Cent	Chewing Efficiency Per Cent	Grains	Retained in Mesh Per Cent	Chewing Efficiency Per Cent	Grains	Retained in Mesh Per Cent	Chewing Efficiency Per Cent	Grains	Retained in Mesh Per Cent	Chewing Efficiency Per Cent	Grains	Retained in Mesh Per Cent	Chewing Efficiency Per Cent
	61.9			25.0			25.0			58.0			26.0			62.0		
4	53.4	0.86	0.14	20.7	0.83	0.17	18.4	0.74	0.26	39.0	0.67	0.33	15.1	0.58	0.42	16.6	0.27	0.73
6	7.0			3.6			6.0			6.7			7.0			7.1		
8	1.0			0.5			1.4			1.3			1.6			3.2		
10				0.3			0.7			0.9			1.4			1.5		
12										0.5						0.7		

*All figures are the average for five tests.

were not encumbered with the stringy fibers found in ham or coconut meat.

For the tests, the food was cut into a definite number of sizes, weighed and then chewed on the right side of the mouth with a limited number of strokes. Potato and like foods of bulk, such as carrots and apple, were cut into eleven quarter inch cubes, while the leafy vegetables were cut into quarter inch squares and enough cut to make up 25 grains. (The cubes of vegetables were a full quarter inch, owing to the freeness of the cutting blade in the guide.)

The degree of fineness of the chewed food was measured with a series of sieves (Fig. 1) placed in descending order according to fineness of the mesh. The mesh of each sieve was a standard size and could be used for determining the fineness of any material. To simplify my explanation, I have called the series of sieves a masticatory gage. The meshes from 4 to 12 inclusive were used in the comparative tests. After chewing the food, the patient placed the bolus or mass of chewed food on the top sieve of No. 4 mesh. The masticatory gage with the food was moved about under a set stream of water for one minute. The water on the particles collected in each sieve was removed as nearly as possible with a linen towel, and the particles were then weighed and the weights tabulated.

The testing process differed from the method of Dr. Gelman.[7] The recent work was done to compare as to fineness the ability of a patient to chew with different teeth; while Gelman's tests were relative to digestion and absorption. He required his patients to chew fifty seconds for efficient mastication.

E. G. Christiansen,[8] of Sweden, in his tests of occluded and articulated dentures for comparative efficiency as to fineness

8. Gelman, S. E.: Die Kaufunktionsprobe, Ztschr. f. Stomatol., 31:866-922, 1933.

required his patients to make fifty masticatory strokes.

In the tests for comparative efficiency of the different cusp forms of artificial teeth, I have required the patient to use ten strokes, although more bites are required in the natural process of eating. As to fineness of chewed food with different teeth, a fair comparison can be obtained by measuring the food collected from sieves of any mesh, and with a small number of strokes. In the tests, I have based efficiency on the amount of comminuted food that passed through the No. 4 mesh. For example, if the chewed mass went through the No. 4 mesh entirely, the efficiency would be 100 per cent. If three-fourths of the total amount passed through the mesh, the efficiency would be 75 per cent. The smaller particles, which were collected in each remaining sieve, were tabulated for future study.

To provide a basis on which to compare the ability of the edentulous patient to chew with that of a person with natural teeth, specimens were cut from the same food and tested for masticatory efficiency. Although the natural denture was not ideal as to occluding relations, it fulfilled all the requirements for the initial investigation.

The crushing power developed by an edentulous mouth in the process of mastication is accepted as being very much lower than the power of the person with natural teeth. The crushing power of the two persons used for the comparative tests was registered with the gnathodynamometer. It was found that the maxi-

TABLE 2.—RAW CARROT TEST*

	Case			Natural Teeth
	1 b	1 c	1 d	
Base stability	Good	Good	Good	
Centric relation	Good	Good	Good	
Lateral balance	Poor	Good	Good	
Anatomic markings	Poor	Poor	Good	Fair
Chewing efficiency (per cent)	15	29	51.5	82

*Table 2 gives a description of salient points which affect the comminution of raw carrots in Cases 1 b, 1 c, and 1 d. It also gives the degree of chewing efficiency in percentages for the artificial and natural teeth.

TABLE 3.—RAW IRISH POTATO TEST WITH CASE 1 B

Mesh	Weight of Food Grains			Average	Retained in Mesh Per Cent	Chewing Efficiency Per Cent
	63.0	63.0	64.0	63.3		
4	43.0	41.0	42.0	42.0	0.67	0.33
6	9.0	9.0	8.5			
8	2.5	2.0	2.0			
10	1.0	1.0	1.5			
12		0.5				

mum force was the greatest in the molar area in each case. The edentulous patient was only able to develop 30 pounds, which was 20 per cent of the masticatory force of the person with the natural teeth.

In the work of constructing dentures for the greatest stability and balance for the tests, the principle of Dr. Phillips'[9] conjunction with Dr. Hight's projected gothic arch tracing device and plaster checkbites. (Fig. 3.)

In this work, some of the registrations were made after the dentures were completed. Although the principle of the technic was the same, the application differed from that ordinarily used.

When denture balance and cuspal co-

TABLE 4.—RAW IRISH POTATO TEST WITH CASE 1 D

Mesh	Weight of Food Grains			Average	Retained in Mesh Per Cent	Chewing Efficiency Per Cent
	63.0	63.0	63.0	63		
4	20.0	23.0	24.0	22	35	65
6	14.0	16.5	15.5			
8	2.5	1.0	2.5			
10	2.0	2.0	1.0			
12	0.5		0.5			

TABLE 5.—RAW IRISH POTATO TEST WITH NATURAL TEETH

Mesh	Weight of Food Grains			Average	Retained in Mesh Per Cent	Chewing Efficiency Per Cent
	64.5	61.5	61.0	62.0		
4	11.5	5.0	9.5	8.6	14	86
6	14.0	18.0	15.0			
8	8.0	9.5	9.0			
10	5.0	5.0	7.0			
12	1.5	2.0	2.0			

central bearing unit was a salient factor. It was used for developing an even and steady pressure in taking impressions with a plastic cement material in vulcanite trays. (Fig. 2.) It proved to be the most satisfactory and gratifying method for registering mandibular movements in

9. Phillips, G. P.: Graphic Reproduction of Mandibular Movements in Full Denture Construction, J.A.D.A., 17:1489 (Aug.) 1930.

ordination were desired, the occlusal surfaces were spot-ground with the aid of carbon paper. Excessive milling with carborundum was avoided, but carborundum was placed between the balanced occlusal surfaces and the case was moved into the various mandibular excursions to remove the uneven surfaces left by the grinding stones.

To make my explanations more com-

prehensive, I will call the artificial dentures made with anatomic teeth, Case 1; the 20 degree posterior teeth, Case 2; the Hall inverted cusp teeth, Case 3, and the Sears channel teeth, Case 4. Case 1 was subdivided into four cases a, b, c and d. Case 1 *a* was a poor set of dentures; 1 *b*, a fairly satisfactory set of dentures; 1 *c*, well balanced and coordinated, but without the necessary supplemental ridges for cutting, and 1 *d*, the most efficient and satisfactory.

Case 1 *a*, although unsatisfactory, had been worn by the patient. Such dentures should be considered typical of a majority of the dentures that are used today. The maxillary denture was rebased to give the patient a little more comfort. The mandibular denture did not fit well and was easily displaced with a movement of the muscles.

TESTS

Case 1 *a*.—Five tests with six different foods were made. (Table 1.) Eleven quarter-inch cubes were cut from carrots, celery, apples and cold boiled ham and weighed, and enough one-fourth inch squares were cut from lettuce and cabbage to make 25 grains. The weighed and tabulated food was then washed through the masticatory gage. The food collected by each screen was weighed and tabulated for study.

The experiment revealed the resistance of different foods to mastication. Carrots seemed to be the hardest food to reduce to small particles. The chewing effi-

Table 6.—Raw Irish Potato Test with Case 2

Mesh	Weight of Food Grains			Average	Retained in Mesh Per Cent	Chewing Efficiency Per Cent
	63.0	63.0	63.0	63		
4	34.0	22.0	26.0	27	43	57
6	6.5	16.0	9.5			
8	2.0	2.0	2.5			
10	1.0	1.0	2.0			
12	0.5	0.7	0.2			

Table 7.—Raw Irish Potato Test with Case 3

Mesh	Weight of Food Grains			Average	Retained in Mesh Per Cent	Chewing Efficiency Per Cent
	64.5	63.5	62.0	63.0		
4	26.5	25.5	27.5	26.5	42	58
6	13.0	14.0	14.0			
8	6.0	5.5	5.5			
10	1.5	4.0	1.5			
12	1.0	1.0				

ciency was 14 per cent. Lettuce was next, followed by cabbage, tender cold boiled ham, celery and apple. The easiest of these foods to chew was apple.

Case 1 *a* was the most inefficient of all the dentures with anatomic teeth tested. The most discomfort and dissatisfaction, as sensed by the patient, were caused by the insecurity and the unseating of the lower denture.

The unsatisfactory function of the teeth was caused mostly by a lack of balance and incorrect centric relation. The mandible was about one-eighth inch too far forward for the proper centric closure.

Case 1 *b* (Fig. 4).—This denture was made by rebasing the lower denture of Case 1 *a*. The base was extended back into the throat for additional retention and the periphery was well muscle-trimmed to prevent displacement in the process of chewing. In the repair, the centric relation was corrected by placing the mandible back in a retruding position. With the aid of carbon paper, some spot grinding was done in the mouth for a three point occlusal balance. The case, when the test was carried out, showed a somewhat immobile upper and lower denture under hand pressure, but, owing to poor balance, the dentures rocked slightly when the teeth were occluded in the lateral positions.

After making many tests with Case 1 *b*, it was found that like foods obtained at various times were surprisingly different in texture. So a fair comparison could not be established with Case 1 *a* on a percentage basis. The patient was quite capable of submitting an opinion of the two cases. With these remade dentures, he could chew with considerable pressure without discomfort. Eating was more of a pleasure than with Case 1 *a*, although he had to refrain from eating foods that were difficult to masticate, especially meat and raw vegetable salads.

Case 1 *c*.—Several months elapsed before new dentures were constructed. This case presented a good denture balance and cuspal coordination. The upper and lower dentures were of the same stability under hand pressure as Case 1 *b*. The incline planes of the cusps of the lower teeth on the right side were quite well carved with primary and secondary ridges. The upper teeth on the same side had cuspal planes which were considered flat.

Table 8.—Raw Irish Potato Test with Case 4

Mesh	Weight of Food Grains				Average	Retained in Mesh Per Cent	Chewing Efficiency Per Cent
	62	63.0	63.0	64	63		
4	50	45.0	40.0	45	45	71	29
6	5	5.0	6.5	6			
8	1	2.0	2.5	2			
10		2.0	1.5	2			
12		0.5	0.5				

Case 1 *d* (Fig. 5).—This was a continuation of Case 1 *c*. The only change was in the chewing surfaces of the teeth on the right side of the maxillary denture. Ridges were carved in the flat incline planes, simulating those of natural teeth.

Chewing tests under like conditions were made with carrots, in Cases 1 *b*, 1 *c*

and 1 *d* and with natural teeth (Table 2). Case 1 *b* was 15 per cent efficient, while Case 1 *c* was 29 per cent. Case 1 *d* was 51.5 per cent efficient, and the natural teeth were 82 per cent efficient.

The sculpturing of the anatomic ridges in the occlusal surfaces of the maxillary teeth of Case 1 *c*, to create Case 1 *d*, gave an improvement of 77 per cent in chewing efficiency. The improvement in the dentures was not only revealed by the figures, but the patient also sensed the ease of cutting and crushing after the shearing ridges were made.

In several instances, prior to the forming of the cutting ridges, it was demonstrated that it was impossible to crush the cubes of carrots when too many pieces found a place between the upper and lower teeth.

To provide a more complete picture of the efficiency of Case 1 *d* as compared with the natural teeth, cold boiled ham and cooked pot roast of beef were used in the experimental work. The pot roast was selected because it was very tender, while the ham was selected because it was fibrous. The results of the tests showed that the artificial dentures were 35 per cent efficient with the ham and 95 per cent efficient with the beef. The natural teeth only ground the ham 19 per cent finer than the artificial teeth, while the beef was reduced only 5 per cent more with the natural teeth.

The 35 per cent chewing efficiency with ham appeared rather low. The ham was better chewed than shown in the percentages. But owing to the stringy fibers, the comminuted particles were held suspended by the wires of the sieve and prevented from passing to the next screen.

Specimens were selected from one large potato for the following described cases in this paper because the comparative efficiency can be more accurately determined. With this vegetable, Case 1 *b* was 33 per cent efficient (Table 3), 1 *d* was 65 per cent (Table 4) and the natural denture was 86 per cent (Table 5).

The remaining investigation with Cases 2, 3 and 4 (Fig. 7) was carried out with a set of dentures (Fig. 6) specially constructed for experimental work. The posterior teeth were removable in groups of four, which were seated in a block of vulcanite. The design was such that each block could be firmly attached with screws to the denture base or removed and accurately reseated at a later date.

Case 2 was constructed with the new 20 degree posterior teeth. Tests were made with these teeth under various conditions. The first test revealed the ill-effect of tenderness of the ridge on mastication, from uneven pressure. The efficiency was reduced perceptibly. In the set-up with the detachable teeth, new registrations were made and recorded by the method previously described in Case 1. In the procedure, two centric relations were made. The first relation was taken when the central bearing unit for equalizing pressure was placed forward. After the teeth were ground for denture balance, the tests showed an efficiency of 57 per cent (Table 6). Two days later, the patient was able to reach an efficiency of only 43 per cent. A tenderness of the mandibular ridge in the bicuspid area of each side had developed, the result of chewing tests two days previously.

The second centric relation was taken when the central bearing unit was placed back about a quarter inch. After spot-grinding for denture balance, the tenderness disappeared. The dentures proved to be satisfactory and comfortable, although the efficiency of 57 per cent was reduced to 53 per cent. The decrease was caused by grinding away the small cutting ridges of the original tooth.

Other experiments were carried out to

show which individual tooth was the most efficient. The first bicuspid was removed from the lower denture on the right side, and one test was made. The efficiency did not change, but remained at 53 per cent. The second bicuspid was then removed, and the efficiency of the first and second molar proved to be only 37 per cent. In addition to removing the bicuspids, the second molar was removed, the first molar remaining. The efficiency of the first molar was 48 per cent, only 5 per cent below the chewing capacity of the four teeth, which was 53 per cent.

The percentage of increase in the last test was no doubt due to the patient's being able to create a maximum force on the first molar, which was the center for equalizing the pressure on the supporting tissues. The displacement with each masticatory thrust was, on account of uneven pressure, at a minimum.

As some doubt has been expressed as to whether bilateral balance is necessary with artificial restorations, a test was made without the block of four balancing teeth of the upper left side. The efficiency dropped to 24 per cent.

A test of efficiency was made to show the effect of a "three point balance." The block of teeth was reseated, and three of the teeth were removed, the upper second molar remaining in place. The efficiency increased to 48 per cent.

The following experiment was conducted with the Hall inverted cusp teeth (Case 3). The degree of denture balance was the same as the best balance of the previous case. The tests (Table 7) revealed that the masticatory function compared very favorably with that obtained with other teeth previously tested. The efficiency was 58 per cent.

The reaction of the patient to this type of tooth was very good, except for the unnatural appearance of the anterior teeth and the fact that the food collected somewhat in the occluding surfaces of the teeth. The patient sensed the evenness of pressure against the supporting ridges while chewing. The displacement was at a minimum at all times. This was undoubtedly due to the lack of interference from the "rise" of cusps, and to the harmonious coordination of the occlusal surfaces during the excursions of the mandible.

The Sears channel teeth (Case 4) were found, in my tests (Table 8), to be in the masticatory function far below what is expected of artificial teeth. Although the articulation of the teeth was given the same consideration as in other types of teeth, the efficiency only reached 29 per cent.

The patient expressed the feeling that he could not grasp the food with his teeth, the particles sliding off the occluding wedgelike surface of the mandibular teeth in the effort to grind and crush the food.

In summarizing the results of the experimental work with the one patient, it was found that:

1. The maximum chewing efficiency was obtained:

(*a*) When the pressure of the base of the dentures was equalized on the supporting ridges in the centric closure and in the eccentric movements.

(*b*) Also when the cutting edges of the occluding ridges were narrow and coordinated with the ridges of the opposing teeth.

2. With specimens selected from one potato, the maximum chewing efficiency of the four well-balanced cases was 65 per cent with the anatomic teeth, 58 per cent with the inverted cusp teeth, 57 per cent with the 20 degree posterior teeth and 29 per cent with the channel teeth.

3. The anatomic artificial teeth, when compared with a set of natural teeth of five times the crushing power, were 75.6 per cent as useful for mastication of raw

potato; 63 per cent, raw carrot; 65 per cent, cold boiled ham, and 95 per cent, cooked pot-roast of beef. The tests were made under like conditions.

CONCLUSION

It is reasonable to believe that the results of the application of the laws of physics and mechanics to the shearing and balancing of artificial teeth (by the research worker) should show a greater degree of certainty if the chewed food is tested by the standard method of measuring the fineness or coarseness of materials.

It is not unreasonable to conclude that many new and advanced principles (advocated by the investigators) used in the procedure of restoring the edentulous mouth of today or tomorrow, to be of any integral or consequential value, should be based primarily upon chewing efficiency regardless of individual preference for the type, form or shape of the artificial teeth, the degree of balance or the precision of the instruments used.

Prosthetic dentistry must have for its constant objective the increasing efficiency of artificial teeth.

The true worth of denture service and the desired position of denture prosthesis in the healing arts will be found in the nearest approach to the restoration of the normal physiologic functions.

An improvement will be attained by those sincere workers of the profession who have the infinite patience to observe and record scientific data.

BEJEL—THE CHILDHOOD SYPHILIS OF THE BEDOUINS: ORAL MANIFESTATIONS

By E. H. HUDSON, M.D., Deir-ez-Zor, Syria

BEJEL is the Arab name for a spirochetal disease found among the nomad Bedouins of the Syrian Desert and the seminomad Bedouins living in their mud huts along the banks of the Middle Euphrates. Of the seminomads, 150,000 live within a radius of 100 miles of Deir-ez-Zor, the only town of importance on the river within the Syrian Mandate.

That bejel is a form of syphilis is confirmed by the morphology of its lesions; the constant presence in early lesions of a spirochete indistinguishable from *T. pallidum;* the constant positive precipitation and complement fixation reactions; the general course of the disease, comprising an early stage, a latent period of varying length and a late stage, and, finally, its favorable response to antisyphilitic therapy.

Seventy-five per cent of the general adult village population state that they have had the disease, and serologic studies show that 60 per cent have positive blood reactions. Surveys based upon serology, history and physical examination have led to the conclusion that 90 per cent of the adult population are affected. Only a small proportion of the total population ever receive any treatment.

The children of the village communities constitute the reservoir and the source of contagion of bejel. Sixty per cent of the adults have acquired the dis-

ease in childhood and a majority of the remainder contract it from children later in life. The propagation of bejel in the community has nothing to do with sex. Unlike venereal syphilis, it is transmitted by immediate nonsexual contacts.

A primary sore or chancre cannot be identified as such in bejel. Its first apparent manifestation is a mucocutaneous eruption. The lesions on the mucous membrane of the mouth are the mucous patches of secondary syphilis, slightly

Fig. 1 (Case 1).—Bejel in Bedouin boy, aged 15.

elevated oval areas, covered with a gray film of desquamated and macerated epithelium. The skin eruption is usually papular and is circinate in distribution. It appears most frequently at the warm, moist folds of the body. Spirochetes in abundance are demonstrable in the mucous and cutaneous lesions.

In the course of a year, these early lesions usually disappear spontaneously, leaving an apparent state of health, though the blood reaction remains positive. After a latent period, which may be many years in length, the subject usually develops one or more late lesions. The commonest late manifestation of bejel is an ulcer involving any or all of the structures in the oral, nasal and pharyngeal cavities. Other late lesions may be in the skin or in the periosteum of the long bones. Spirochetes are usually not to be found in the late lesions,

Fig. 2 (Case 2).—Bejel in Bedouin girl, aged 8.

which are gummatous. Trauma seems in many cases to determine their site. In a group of 186 Bedouins with bejel, 104 had lesions in the mouth, pharynx, larynx and nose; thirty-nine had ulcerations elsewhere, and fifty-five had skin eruptions. In other words, more than half of all bejel lesions may be discovered by an examination of the mouth, nose and throat.

The oropharyngeal ulcer which is so

characteristic of late bejel begins with congestion accompanied by pain. The congestion tends to localize at one point, where continuity of the mucous membrane is lost, and a small ulcer appears. In a short time, this ulcer grows to large size and is covered with a yellow slough, which cannot be removed without considerable difficulty and pain. The base of the ulcer bleeds easily. Spirochetes indistinguishable from *T. pallidum* can sometimes be found in scrapings. If left untreated, such ulcers extend slowly to include neighboring structures, eroding

Fig. 3 (Case 3).—Bejel in Bedouin woman.

extensively in all directions, and healing very slowly, with the production of extensive distorting bands and sheets of scar tissue. The presence of such a scar in the pharynx is of great diagnostic value in bejel.

Fortunately for the patient, these mouth lesions are quickly responsive to arsenical and bismuth treatment, 1 gm. of either usually being sufficient to accomplish relief of pain and healing of the ulcer.

SUMMARY

1. Bejel is a childhood acquired nonvenereal syphilis of the Bedouins whose course comprises two stages, the early and the late, separated by a latent period of varying length.

2. Oral lesions are characteristic features of both early and late stages. The early oral lesions are mucous patches, and the late lesions are ulcers, which may attack or extend to include any structure within or contiguous to the mouth.

REPORT OF CASES

Case 1.—A Bedouin boy, aged 15, who had contracted bejel from a younger brother six months previously, presented a mucocutaneous eruption consisting of scattered papules on the arms, thighs and back, soft papules on the scrotum and penis, a huge condyloma of the anus and mucous patches on the tongue, buccal surfaces and tonsils. The case improved under bismuth injection treatment. (Fig. 1.)

Case 2.—A Bedouin girl, aged 8, with a recently acquired bejel, had a blood Kahn reaction of 4 plus. After the usual mouth eruption, she had developed a sore on the tongue, two months previously. She was a well-nourished and apparently healthy girl, except for general adenopathy and a fissured ulcer of the dorsum of the tongue. The ulcer had somewhat the appearance of a late lesion, but the history indicated it to be early. Injection of less than 0.5 gm. of bismuth healed the lesion. (Fig. 2.)

Case 3.—A Bedouin woman, aged 33, who had had bejel in childhood, had a blood Kahn reaction of 4 plus. She was perfectly well after the early infection until she reached the age of 32, when she began to have pain in the throat, followed by pain in the nose. She had much nasal discharge and headache, with dysphagia, and liquids when swallowed were partially returned through the nostrils. More recently, she had had soreness and discharge about the upper incisors. On examination, one year after the onset of these late symptoms, she

was found to have complete erosion of the uvula and soft palate, collapse of the nasal bridge and perforation of the septum, a granulating mass filling both nostrils, and necrosis of the alveolar process. The two upper central incisors and the right lateral incisor, shown in Figure 3, were lifted out with forceps *en bloc* with the alveolar process.

BIBLIOGRAPHY

Hudson, E. H.: Treponematosis Among Bedouin Arabs of Syrian Desert, U. S. Nav. M. Bull., 26:817-825 (Oct.) 1928.

Hudson, E. H., and Young, A. L.: Medical and Surgical Practice on Euphrates River, Am. J. Trop. Med., 11:297-310 (July) 1931.

Hudson, E. H.: Syphilis in Euphrates Arab, Serologic Study, Am. J. Syph., 16:447-469 (Oct.) 1932; Clinical Study, ibid., 17:10-44 (Jan.) 1933.

Hudson, E. H., and Young, A. L.: Arab Syphilis, Further Serologic Studies, J. Christian M. A. India, 8:284-294, 1933.

Hudson, E. H.: Juxta-Articular Nodules in Euphrates Arabs, Tr. Roy. Soc. Trop. Med. & Hyg., 28:511-522 (March) 1935.

Hudson, E. H.: Hyperkeratoses and Depigmentations in Bejel, Ann. Trop. Med., 30:3-6 (April) 1936.

Hudson, E. H.: Bejel: Nonvenereal Syphilis, Arch. Derm. & Syph., 33:994-1011 June) 1936.

Hudson, E. H.: Reaction to Presumptive Kahn Test in Patients with Bejel (Nonvenereal Syphilis), Arch. Path., 21:727-738 (June) 1936.

Hudson, E. H.: Mucocutaneous Syphilis (Bejel) in Syria. Results of Darkfield Examination, New England J. Med., 215:392-396 (Aug. 27) 1936.

Hudson, E. H., and Crosley, S. S.: Influence of Bejel on Second Generation, Brit. J. Dermat., 48:288-299 (June) 1936.

Hudson, E. H.: Kahn and Kolmer-Wassermann Reactions in Bejel, Am. J. Syph., Gonor., & Ven. Dis.; to be published.

Hudson, E. H., and Crosley, S. S.: Bismuth in Treatment of Endemic Syphilis (Bejel), Brit. J. Trop. Med. & Hyg., October, 1936.

PRACTICAL APPLICATION OF A NEW AND SCIENTIFIC METHOD OF PRODUCING TEMPOROMANDIBULAR ROENTGENOGRAMS*

By L. B. HIGLEY, B.A., D.D.S., M.S., Iowa City, Iowa

THE health professions have for years been trying to determine the etiology of certain head conditions which some investigators have recently attributed to discrepancies of the temporomandibular joint. A few have presented a classification of the anomalies of this joint and the symptoms peculiar to each; others have suggested methods of treatment; while still others have contributed to the subject as a whole, advancing ideas on etiology, diagnosis and treatment. For these contributions we are indebted to Prentiss,[1] Wright,[2] Decker,[3] Harris,[4]

*Read before the Section on Partial Denture Prosthesis at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 15, 1936.

1. Prentiss, H. J.: Preliminary Report upon Temporomandibular Articulation in Human Type, D. Cosmos, 60:505-514 (June) 1918; Regional Anatomy, Emphasizing Mandibular Movements with Specific Reference to Full Denture Construction, J.A.D.A., 10:1085-1099 (Dec.) 1923.

2. Wright, W. H.: Deafness as Influenced by Malposition of Jaws, J.A.D.A., 11:979-992 (Dec.) 1920.

3. Decker, J. C.: Traumatic Deafness as Result of Retrusion of Condyles of Mandible, Ann. Otol., Rhinol. & Laryngol., 34:519-527 (June) 1925.

4. Harris, H. N.: Anatomy of Temporomandibular Articulation and Adjacent Structures, J.A.D.A., 19:584-590 (April) 1932.

Goodfriend,[5] Costen,[6] Maves, Riesner,[7] Gillis and others.

Because I had my undergraduate work under Prentiss, just at the time when he was presenting his papers to the dental profession on the subject of the temporomandibular articulation, and because some of his enthusiasm carried over to the student body, it was only natural that my attention was directed to the importance of this joint early in the dental course. Later, while I was teaching orthodontia and treating cases, the relationship of the condyle and fossa became of increasing interest to me because of its importance in closed and open bite, and in lateral, mesial and distal malposition of the mandible, as well as in the treatment of these conditions. It was my privilege still later, while taking graduate work, to attend Prentiss' graduate courses in head and neck the two years just prior to the death of this great anatomist. This background was undoubtedly the reason for my continued interest in this articulation and the adjacent structures.

Since the time of the first presentation by Prentiss, the dental and medical literature has contained an increasing number of articles calling attention to the importance of this joint with special reference to its rôle, when abnormal, as an etiologic factor in the production of pain and discomfort. Pathologic and anatomic abnormalities of the joint have been indicated as giving rise to the following symptoms: impaired hearing; stuffy sensation or low buzz in the ears or a snapping noise in chewing; dull pain within and around the ears; dizziness, either mild or severe; headaches, usually on the top or in the back of the head or around the ears; a burning sensation in the throat, on the tongue or on the side of the nose, and dry mouth or excessive salivation. Although pathologic processes derived from a tooth or some other infection involving the joint may be the instigating cause in some cases, the most common cause is functional disturbances of the joint and the ligaments and muscles controlling it.

Fig. 1.—Anatomy of temporal muscle. The masseteric nerve emerges through the sigmoid notch between the external pterygoid and temporal muscles, directly in front of the temporomandibular articulation, to enter the masseter muscle. (From Deaver's "Surgical Anatomy," P. Blakiston's Sons & Co., Inc., publishers.)

While this paper will deal primarily with the scientific application of the roentgen rays as an aid in diagnosis and treat-

5. Goodfriend, D. J.: Symptomatology and Treatment of Abnormalities of Mandibular Articulation, D. Cosmos, 75:844-852 (Sept.); 947-957 (Oct.); 1106-1111 (Nov.) 1933; Abnormalities of Mandibular Articulation, J.A. D.A., 21:204-218 (Feb.) 1934.

6. Costen, J. B.: Syndrome of Ear and Sinus Symptoms Dependent upon Disturbed Function of Temporomandibular Joint, Ann. Otol., Rhinol. & Laryngol., 43:1-15 (March) 1934.

7. Riesner, S. E.: Temporomandibular Articulation: Its Consideration in Orthodontia Diagnosis, Internat. J. Orthodon., 22:1-28 (Jan.) 1936.

ment, it is impossible to exclude a discussion of some observations that may have a bearing on the etiology of certain conditions mentioned and certain additional ones. For example, some investigators attach importance to the effect of erosion of the glenoid fossa and tympanic plate, thus accounting for involvement of the hearing mechanism and the dura. I feel that there has been nothing except speculation on the question as to whether such erosion is ever produced by action of the mandible. It is possible that what seems to be erosion is in reality a congenital defect. In Prentiss' work, even perforations of the meniscus were found only in old edentulous jaws. Again, it is undoubtedly true that some of the anatomic conclusions advanced are primarily from introspection, and certainly a great deal more work is necessary to verify them.

Clinical observations have proved that the abnormalities of function of this joint may, when the effects are analyzed, be shown to produce practically all of the symptoms previously described. Briefly stated, then, the greatest difficulty seems to arise in those cases in which there is an

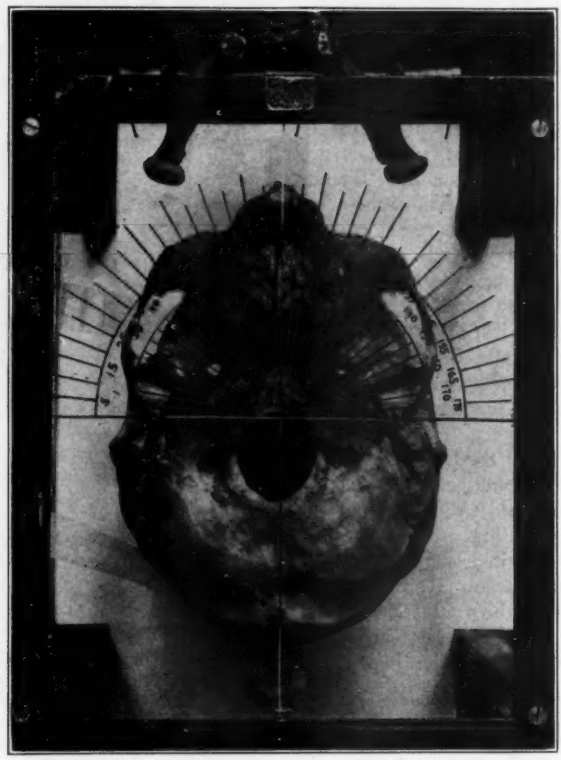


Fig. 2.—Base of skull oriented for measuring angle of eminentia. The angle of the condyle head at the top of the illustration is to be noted.

overclosure of the mandible, and the treatment naturally would be the correct repositioning of the lower jaw. The customary symptoms are not so prevalent in closed bite conditions as defined by the orthodontist, which develop gradually and in which anatomic adjustments in the joint may be made. They occur, mostly, in those cases wherein there is a loss of support due to occlusal abrasion or to loss of the molars on one or both sides, replaced with ill-fitting or poorly made dentures, if at all.

As a result of this loss of support, an overclosure of the lower jaw occurs, causing the capsul as well as the jaw muscles and ligaments to be compressed or to buckle and bulge, and so to injure

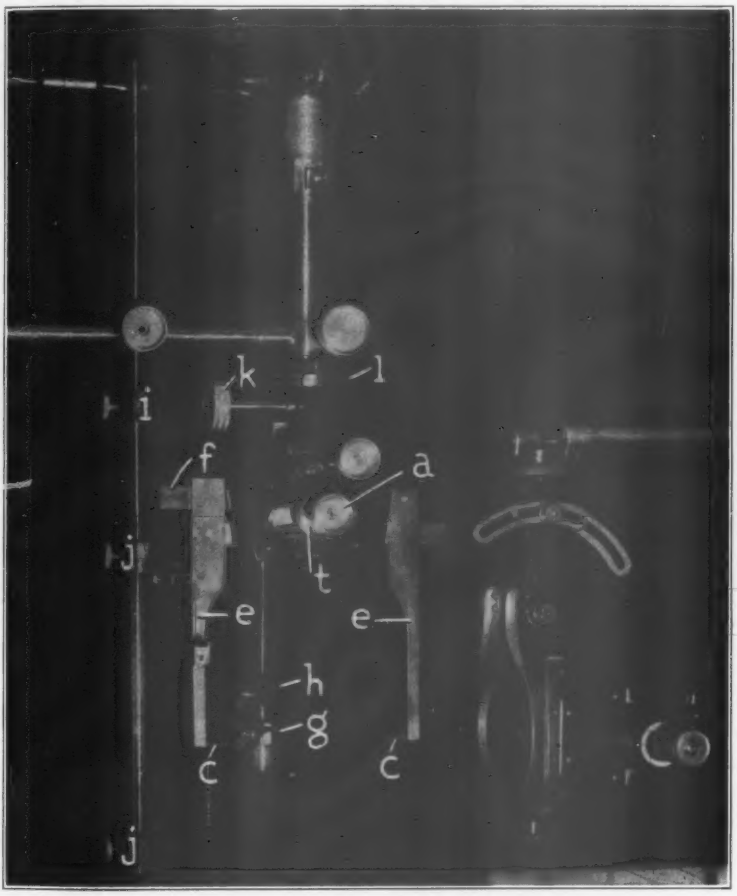


Fig. 3.—Head positioner and casette as suspended from ceiling above dental chair.

themselves or impinge on neighboring structures; namely, the eustachian tube and certain nerves. Such impingement may actually close the eustachian tube, giving a subsequent chance for infection and its attending evils. The far-reaching results attributed to impingement on the nerves are due to their being branches of large important nerves of the head. These supply many areas and so transmit the numerous symptoms to the different localities referred to.

The nerves so impinged on are, according to most investigators, the chorda tympani and auriculotemporal. The conclusions regarding the chorda tympani are questionable. In instances of a radical double mastoid operation, the chorda tympani is often destroyed and patients are reported to be entirely unaware of its loss. It is no longer considered a branch of the seventh or facial nerve, but rather a branch of the ninth. It may, nevertheless, have some connection with the condition of dry mouth and excessive salivation. Regardless of this theory, since the auriculotemporal nerve is a branch of the large mandibular branch of the fifth cranial nerve, pressure on it alone could be responsible for the majority of the symptoms, including those of dural origin. This fact has been verified by the neurologist of the medical staff of the University of Iowa. Since the auriculotemporal nerve is a branch of the trifacial, it is possible that impingement on it may give rise to the symptoms of trifacial neuralgia. This important possibility was suggested to me by Maves and is conceded to be plausible by our neurologist.

Again, in the case of dysarthrosis of the joint, as described by Goodfriend,[5] the cause, it seems to me, might easily be impingement on the masseteric nerve due to its anatomic position, resulting in a spasm of the masseteric and temporal muscles. (Fig. 1.) The masseteric nerve is a branch of the temporal, which supplies the temporal muscle. These nerves are in turn branches of the trifacial. This cause of dysarthrosis, while only conjecture on my part, seems to be logical.

Fig. 4.—Routine views taken of each temporomandibular articulation studied: Left, physical rest, teeth in occlusion. Center, physiologic rest, teeth separated in relaxed rest position. Right, mouth opened a measured amount.

It may be well to emphasize at this point that many patients have had one or several of the symptoms mentioned remain after the previously known causes, such as eye involvement and lesions of the sinuses or ears, have been found negative or pronounced cured by the head specialist. It has been further demonstrated that the same patients have been given temporary relief by inflation of the

eustachian tubes or by holding the jaws apart with cork disks of adequate width (Costen method). Later, permanent relief has been provided by the placing of well-made dentures, which renewed molar support and established proper articulation of the condyle with the fossa.

Therefore, since these symptoms may all be traced directly or indirectly to pressure supposedly from an incorrect condyle-fossa relationship, brought about by an overclosure of the mandible, it became exceedingly important to study the normal physical relations of this joint both at rest and in its various excursions, in order to make a comparative study of a joint in which an abnormality was suspected. Furthermore, since treatment consists in supplying the patient with dental restorations that will establish correct condyle-fossa relationship, some means is required to evidence that this has been accomplished. After investigation of several methods, the use of roentgenograms of the joint was found to best serve this purpose.

The idea has been advanced that the physiologic rest position of the mandible remains constant throughout life and that the condyle-fossa relationship, in this position, may, therefore, be taken as the guide in repositioning the mandible. If the bite is opened in excess of this physiologic rest position, a strained appearance of the lower third of the face results. It is therefore necessary to open the bite somewhere between the physical and physiologic rest positions. The roentgen rays may be used to determine both these positions, or the constant physiologic alone if the physical has been lost, as is generally the case. If the roentgen rays are to be of service, they must be employed in a technic that can be standardized.

Chamberlain,[8] in discussing the requirements of a good technic for roentgenography in general, and of the temporomandibular joint specifically, gives the following:

(1) The distance between the focal spot of the X-Ray tube and the film must be set and the same distance used in every case. (2) The angle of incidence (and emergence) of the center of the X-Ray beam with reference to the patient's skull must be measurable and reproducible. (3) The angle of incidence of center of X-Ray beam upon the film must be fixed, and the same angle used in every case. (4) If studies are made with open bite as well as with teeth in occlusion, the degree of openness must be measured and fixed, especially if the right and left joints are being compared with each other, or if studies of the same joint, on different dates are to be compared.

Now, if the film can be parallel to the area to be roentgenographed and the midcentral ray passes through the center of this area and yet is at right angles both to the area and to the film, the situation is ideal. The term "area" has been used instead of "object" because the resulting roentgenogram is to picture a relationship of condyle to fossa rather than any single part. Since the eminentia is approximately in the center of the arc of movement of the condyle and is a convenient landmark by which to establish the condyle position, it has been chosen, in this technic, as the center of the area anteroposteriorly, and its crest as the center of the vertical dimension. If, then, the center of the roentgen-ray beam could be made to lie on the same plane as, and in a direct line with, the crest of the eminentia, and the film could be in a plane at right angles to the area and the midcentral ray, all of the requirements for correct angulation would be met.

With these considerations in mind, the problem of roentgenographing the temporomandibular joint was attacked. It was then necessary to determine:

8. Chamberlain, W. E.: Disc. Riesner, Footnote 7.

1. What angle or angles the condyle, the glenoid cavity or fossa and the eminentia hold with respect to the head.

2. Whether a roentgenogram of these parts could be taken in such a manner as to satisfy all of the conditions conceded to be requisite to the most accurate roentgenographic technic as far as physical relationship of film, object and source of rays is concerned.

In order to answer the first question, a study was made of 250 skulls and about sixty cadavers. The number of skulls and cadavers examined has been increased since the original study, and Maves, in a personal communication, has substantiated the findings given here after charting this area on 2,000 skulls at Western Reserve University. In my study of skulls, an instrument was devised consisting of a flat wooden base and four upright legs for support of a framed glass. (Fig. 2.) On the glass were etched two lines at right angles to each other, and a protractor with the shorter horizontal line, as its base. All of the etched lines were filled with India ink to make them more clearly discernible.

A skull with the mandible removed could then be slipped under the glass and held in such a manner that the base of the protractor passed through the transmeatal plane, which lies at right angles to the median sagittal plane and passes from the midpoint of one external auditory meatus to the other. The skull was also oriented so that the vertical line was caused to lie over the median sagittal plane. (Fig. 2.) In this manner, it was easily possible to read directly the angle that the eminentia made with the transverse plane, when the center of rotation was at the intersection of the midsagittal and transverse meatal plane. (Fig. 2.) As can be seen in the picture, this angle is 20 degrees.

The eminentia, through another set of measurements, was found to have a downward and inward angulation of about 6 to 8 degrees with the Frankfort plane. It follows, of course, that the fossa has the same angulation as the eminentia.

Similarly, the head of the condyle, when studied, portrayed, in the majority of cases, the same angulations, although some offered considerable variation in shape and consequently in angulation; as might be expected, at least by those having made a study of this joint.

Regardless of those variations found in the condyle head, it is important to note that the majority followed the angulations mentioned and that the angulation for the eminentia and glenoid cavity remain practically constant in all cases. Therefore, when correct angulations are used in roentgenographing the eminentia and fossa, if the condyle head is like the majority, a profile view of it will be obtained in correct relation to the fossa and eminentia, and if it is unlike the majority, the discrepancy will be shown, and it will still be obtained in its correct relationship to the rest of the joint.

These angulations of the various parts of the joint having been determined, it is found that, in order to comply with the four previously mentioned conditions and thus produce a true roentgenogram of the eminentia and fossa and an exact profile of the condyle, the skull or patient's head must be oriented on some horizontal plane, such as the Frankfort, then rotated horizontally 20 degrees and tipped laterally 6 degrees; while all the other physical relationships between the film, area to be roentgenographed and the source of the roentgen rays are correctly held.

In answering the second question, then, it was still necessary to decide whether ideal roentgenographic technic could be applied to this joint, using the

correct plane and angulations, not have certain other structures superimposed and thus cover up the details.

As a preliminary study, a skull was oriented and roentgenographed, with quite gratifying results. Thereafter, several exposures were made with graduate students as subjects. The results again indicated the practicability of the method.

Several things were yet to be desired: one, an apparatus that would position the patient's head and casette in correct relation to each other and hold them immobile, and also make it possible to replace the head in exactly the same position at a future date. Still another problem was to make the apparatus usable for the dentist from the standpoint of expense and space required for the equipment.

The apparatus finally evolved consists of a head positioner with casette holder (Fig. 3), which is described in detail elsewhere.[9] The head positioner with casette is suspended above the dental chair from a ceiling support, and since it can be taken from and replaced in its support easily and quickly, it is out of the way when not in use. The lowest point of the ceiling support with the head positioner removed may be 74 inches from the floor.

The patient is seated in the chair and raised until the external auditory meatus, or ear holes, are on a level with the small ear rods. (Fig. 3, *c-c*.) When the knob *a* is turned, these ear rods at the lower extremities of the arms *e-e* move toward each other simultaneously and enter the ear holes, thus automatically centering the head. Calibrations on the arm *f* indicate the distance that the ear rods enter the ear holes, making it possible always to use the same amount of compression for subsequent pictures.

The head is then adjusted vertically so that the pointer *g* touches the lower border of the bony orbit. The stabilizer *h* is then adjusted to press lightly against the head at the nasion in order to preserve this position, and the orbital pointer is released. The head has thus been oriented on the Frankfort plane.

The film contained in the casette is now positioned. The casette holder is completely adjustable, so that the casette may be brought in relation with the arm *e-e'*, Figure 3, this depending on the joint to be exposed, and positioned through the use of a small square, so that the film will cover the desired area and will be at right angles to the midsagittal plane of the patient's head.

Either a small occlusal casette 2¼ by 3 inches, equipped with high speed screens and a film cut to fit from a larger ultraspeech film, may be used, or a larger casette will serve and may be positioned so that a small cut portion of film will fall over the area to be roentgenographed. If the occlusal casette is to be used, it is inserted in the single casette holder. (Fig. 3, *i*.) If a larger one is to be employed, the double casette holder, *j-j'*, is used.

If a dental x-ray machine is used, the cone is adjusted so that it will just miss the surface of the arm *e* or *e'* opposite the joint to be exposed and will be on the same level as the ear rods, and so that the midcentral ray will also be at right angles to the midsagittal plane of the patient's head.

This head positioner is so designed that it will duplicate the angulations of the joint as found in the previous study. Thus, it can be rotated on the horizontal plane and tipped laterally, the center of rotation being the junction of the midsagittal and transverse meatal planes midway between the ends of the ear rods.

9. Higley, L. B.: New Head Positioner and Casette Holder for Producing Scientific Photographs and Radiographs, Internat. J. Orthodon., 22:699 (July) 1936.

Since the previously computed angles can be duplicated with the head positioner, we proceed to this next step as follows. In roentgenographing the left joint, the operator, when standing back of the patient, releases the head holder for rotation on the horizontal plane by turning the knob *k*, Figure 3, after which the head and positioner are rotated counterclockwise 20 degrees, as indicated on the calibrated disk, *1*. This then causes the midcentral ray to enter the right side of the head just about distad to the mastoid, on the same plane as, and in direct line with, the eminentia and condyle head. Thus, both the rays and these structures are now at right angles to the film and, in the average case, the exact profile of the condyle is procured. Now by releasing the knob *t*, the head is tipped laterally in a counterclockwise manner 8 degrees, as indicated by the calibrations under this knob.

At this time, all the conditions of correct and scientific roentgenographic technic are complied with, since the relations of all parts are correct and the film and patient's head have been made immobile. The vertical position of the head in this technic seems to be an advantage, because, when the patient rests his head on a table, the mandible tends to swing laterally from its own weight.

One additional procedure, which lends brilliance to the roentgenogram, may be profitably discussed. This is the use of diaphragms, cones or the Potter-Bucky diaphragm. The center of the aperture of the diaphragm or cone should be exactly in the line of the midcentral ray, and the size of this opening is computed by the following formula.

$$\frac{\text{anode—diaphragm distance}}{\text{diameter of aperture}} = \frac{\text{anode—film distance}}{\text{diameter projected circle}}$$

Suppose the roentgenogram is to include an area 2 inches in diameter when employing a 15-inch anode film distance and 3-inch anode diaphragm distance: What would be the diameter of the diaphragm or cone aperture?

$$\frac{3}{x} = \frac{14}{2}.$$ Then $14x = 6$ and $x = \frac{3''}{7} =$ diameter of aperture.

A complete discussion of diaphragms may be found in the medical division of *Radiography and Clinical Photography*, July, 1933; while all the known approaches for obtaining roentgenograms of the condyle are referred to in the September issue, 1933.

CONCLUSION

I wish to repeat that this is the only method known to me wherein all the requirements for the best roentgenographic technic have been applied to a lateral view of the temporomandibular joint. Regardless of the apparatus that one may choose to orient the head and immobilize it and the film, the method of approach seems worth while. By the systematic use of a scientific apparatus of the type herein described, original and check-up roentgenograms of this area, as well as all other roentgenograms and photographs of the head, may be more accurately produced.

A SIMPLE CONTROL FOR PRACTICAL CASTINGS*

By R. E. STURDEVANT, D.D.S., Lincoln, Nebr.

THE application of a casting technic in dentistry has gone through twenty-five years of practical service. The dental profession can boast of the progress that has been made in casting technics during the short period of time. The old plate golds of earlier days have been replaced by highly specialized alloys which possess definite physical properties that meet the varied requirements arising in restorative dentistry. Waxes for pattern work have been variously modified. Crude investments of a few years ago have been advanced to a point where raw materials are carefully selected, accurately proportioned and blended under precisely controlled conditions. These improvements are the result of extended research conducted by persons grounded in scientific fundamentals, urged on by professional criticisms and requirements. With this forward movement also have come great improvements in casting equipment and accessory products. Old technics have been revised and many new ones advanced. This progress has been made possible through the united efforts of the dentist, laboratory technician and manufacturer, always guided by the fine work of the Bureau of Standards.

If the auto mechanic is criticized because his measurements are three-thousandths inch from being perfect, is it not reasonable to expect the dentist, who is working on a part of the human body, to produce gold castings which are nearly as accurate? Knowing how indispensable casting is to the general practitioner, I shall endeavor to put forth a simple technic which can enable the dentist to gain such accuracy. (Fig. 1.)

Before taking up the technic proper, it is best to consider briefly the wax pattern. Without a true wax pattern, the most careful technic ever devised surely would be unsatisfactory. The gold inlay can be only as good as the wax pattern.

In the direct inlay, we are confronted with the problem of removing the wax pattern from the tooth. Let us consider some distortions resulting from its removal. When the wax pattern is removed by the use of an explorer inserted in either the mesial or the distal body of a mesioclusodistal cavity, there is extreme danger that the portion of the wax in which the explorer is inserted will move from the cavity before the body of wax on the opposite side of the tooth does, a distortion of the wax pattern resulting.

In the indirect method, the common mistake is the removal of a wax pattern from a die by a sprue pin, resulting in a line of force comparable to that which arises from the explorer technic of removal. The exertion of leverages undoubtedly will give a distorted wax pattern. (Fig. 1.) In the minds of many dentists, the swaging of castings on a die seems to be a cureall for such mistakes.

Likewise, the explorer type of removal of wax patterns in interproximal cavities with dovetail occlusal extensions will

*Read before the Section on Operative Dentistry, Materia Medica and Therapeutics at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 15, 1936.

bring similar distortions. (Fig. 2.) This can be easily avoided by the use of a fine U-shaped wire, inserted in the wax in such a manner as to lift the wax pattern *en masse* with uniform traction on the various bodies of wax. The U-wire can be inserted by holding it in the slightly warmed points of a cotton plier. On insertion of the wire to the proper depth, the pliers are released, and thus the wax pattern is freed from excessive heat.

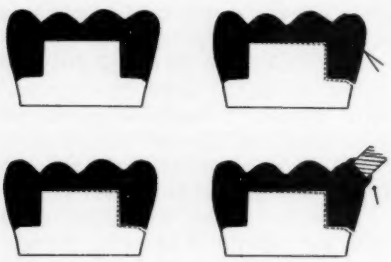


Fig. 1.—Improper removal of mesiocluso-distal patterns.

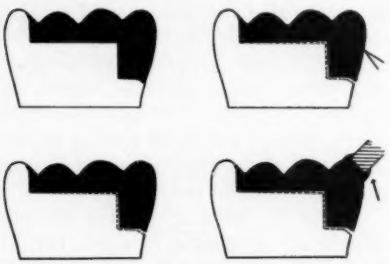


Fig. 2.—Improper technic for removing wax patterns in two surface cavities which have dovetail occlusal extensions.

(Fig. 3.) After the pattern has been removed and mounted on the crucible former, the wire can be removed by the use of the warmed points of the cotton pliers, the operator being careful to draw out the wire as soon as sufficient heat has been incorporated for its release, thereby minimizing the danger of distorting the wax pattern. In this particular technic of removal, it is not necessary to use extremely cold water for chilling the wax. Extremes in temperature are undesirable in handling wax patterns.

After care has been taken to obtain a pattern that fits as nearly accurately as possible, attention is directed to the next procedure, sprueing. In too many lab-

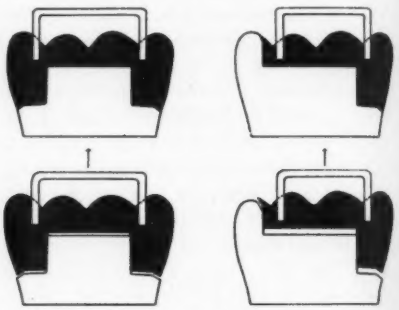


Fig. 3.—Proper technic for removal of wax patterns.

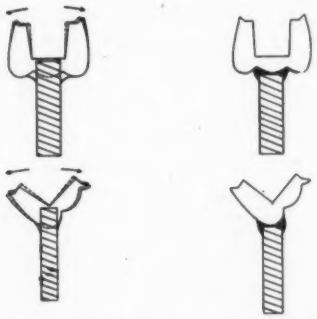


Fig. 4.—Left: Improper spruing. Right: Proper spruing.

oratories, the sprue is considered only as a means of holding the wax in position to receive the investment. Little consideration is given to its diameter, length and shape, or to the metal used, all of which are important. As to the diameter, pins from 12 to 18 gage should be used

according to the size of the wax pattern. Sprues of the largest diameter should be used to prevent porosity at the union of the sprue with the main body of the casting. This can also be overcome by using a reservoir, which must be placed very close to the wax pattern and connected by a heavy channel to facilitate the drawing of the area of porosity into the center of the reservoir. Many make the mistake of having reservoirs too small for the size of the inlay, the attachment of the reservoir to the main body of the inlay being too small or the reservoir being too far away from the pattern, and thus acting only as a sprue button that is too far away from the mold. Reservoirs are not necessary in making small castings, for if the sprues are large enough and sufficiently short, the gold in the center of the sprue

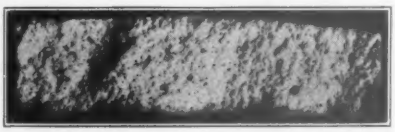


Fig. 5.—Cross-section of hand spatulated investment showing trapped air bubbles.

chamber will remain molten long enough to furnish liquid gold to fill up the voids, a solid casting resulting.

The sprue pin should always be straight, never tapered, as a tapered pin only tends to resist the flow of molten gold in the sprue chamber and increase the velocity of the metal as it enters the mold; which is very undesirable in the seating of gold against weak investments.

The final consideration in the selection of a sprue is the metal used. A steel pin is undesirable unless removed reasonably soon, since it will leave iron oxide against the wall of the sprue hole. This oxide, during the process of casting, will be picked up by the molten gold, contamination resulting. This danger can be easily averted by the use of brass sprue pins, which are very inexpensive.

After the proper sprue pin has been selected, the pin is attached to the wax pattern, the greatest bulk of wax always being selected for the attachment, this precaution serving to prevent "shrink spot" porosity. It is unwise to insert a heated sprue pin in the surface of the wax, as the heat conveyed by the pin is likely to distort the pattern. This distortion can be avoided by placing a drop of

Fig. 6.—Casting showing results of improper spatulation of investment. The gold nodules are to be noted.

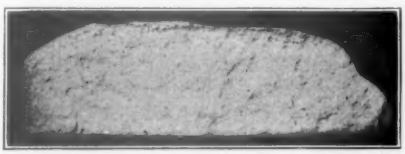


Fig. 7.—Cross-section of mechanically spatulated investment.

sticky wax on the pattern at the point of attachment and inserting the pin in the warm wax. (Fig. 4.) If an instrument is to be used in sealing the attachment, it must be a thin bladed one, since a heavy instrument will radiate heat, which may round a feather edge margin.

The next procedure is the mounting of the case in the crucible former. The distance between the wax pattern and crucible former is short, in agreement with the short sprue chambers. A drop or two of sticky wax may be placed about the opening at the bottom of the crucible former to make sure that the sprue pin remains in its proper position. A careful technician will make sure that the surface of his crucible former is always clean and buffed to insure a smooth crucible surface on the investment.

The wax pattern is now cleaned with a solution composed of equal parts of hydrogen peroxide and green soap in

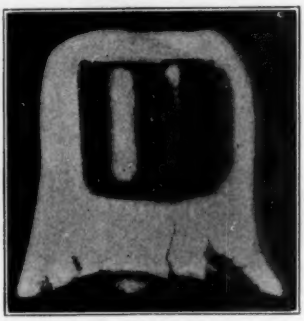


Fig. 8.—Smooth casting obtained by using mechanically spatulated investment.

order to remove the die lubricant in the indirect method and saliva and lubricant in the direct method. In the rinsing of the pattern, extremes in temperature can be avoided by the use of room temperature water. An air syringe is used to dry thoroughly the surface of the wax pattern, because the presence of free moisture on the surface of the wax will result in a rough casting.

To produce accurate dental castings, inlay investments are of no less importance than inlay waxes and their manipulation. A short period of ten years ago saw the dentist using an investment with no consideration of its physical properties. Needless to say, this opened a great field for a survey of the types of investments in use, and experiments have been conducted to determine their qualities. As a result, the dentist may now wisely choose his investment after careful consideration of the physical properties of current casting investments.

After a series of laboratory tests, I have chosen an investment the physical properties of which make it most satisfactory. The observations made by the Bureau of Standards in January, 1936, show this investment to be well above their specifications. Most important of all is the study of these observations relative to water-investment ratios, noting

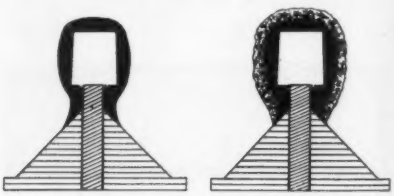


Fig. 9.—Left: Painting with inner core. Right: Application of sponge core.

the increase of all the desirable qualities with a decrease of the water content.

To make the first mix of investment, the investment and water are measured with a very simple device, a set of measuring spoons, which can be purchased at any 10-cent store. In the clean bowl of a mechanical spatulator are placed 2 teaspoonfuls of room temperature water and 2 level tablespoons of tightly packed investment. Distilled water is preferred to tap water, since tap water usually contains mineral salts, which may increase or retard chemical reactions in the investment. The mixing is begun with a hand spatula to insure the initial union of water and investment before application of the mechanical spatulator. This pro-

cedure prevents gumming up of the dry investment about the central axis of the mechanical mixer, which often discourages its use. The mechanical spatulator is indispensable if for no other reason than that it assures a homogeneous investment-water mix and greatly reduces entrapped air in the investment. This elimination of air bubbles contributes more to the smoothness of castings than any other single factor. (Figs. 5-8.)

A minimum of 150 turns of the blade or of 50 turns of the handle over a period of thirty seconds is required. With an inlay paint brush, a thick mixture is applied to the wax pattern, the operator gently vibrating the investment to place

Fig. 10.—Cross-section of invested case, showing inner core, sponge core and outer investment.

and being careful not to bridge across angular depressions. After the wax has been properly covered to a depth of one-eighth inch, more of the thick mix is added about the sprue pin down to the crucible former, the operator making sure that enough is covering the crucible former in order to secure an appreciable lip of the smooth investment. This precaution insures the best possible channel for seating the gold in the mold.

The next step is to sprinkle dry investment on the surface of the case, then gently vibrate by stroking a roughened instrument across the edge of the crucible former. During this procedure, moisture is drawn from the inner investment; which reduces its water content and furnishes additional moisture for the application of more dry powder. The application of dry investment is repeated until a thick sponge core, which will serve a multiple purpose, is formed. (Fig. 9.) After the addition of the sponge core, the excess of this layer, which lies upon the crucible former, is removed by the blade of a hand spatula and trimmed just inside the lip of the heavy inner investment, and thus any roughened surface of the crucible face of the investment is eliminated. The bene-

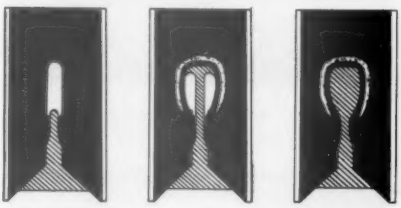


Fig. 11.—Left: Result of failure to cast gold in sealed pyrex glass tubing. Center: Result of replacing end of tube by ball of wax; showing gold being seated in mold. Right: Completed casting.

fits of the sponge core can be listed as follows: 1. Reduction of water content in the inner core of the investment. 2. Accommodation for the expansion of investment, both setting and thermal. 3. Reduction of the resistance to the escape of air in the seating of the molten gold.

As has been said before in the discussion of the phyiscal properties of the investment, a reduction in the water content is accompanied with an increase in tensile strength, compression strength, setting expansion and thermal expansion, as well as a reduction in the setting time.

Therefore, the addition of a sponge core and the consequent reduction of water in the inner core which lines the mold assures those properties which are essential to an accurate casting.

Surely it is more advantageous to have a cushion stabilizer in the center of an investment than to accommodate the lateral expansion by the use of an asbestos liner at the periphery. An inner core of investment that is free to expand in all directions aids materially in producing true, unwarped castings. Without the central cushion, investments, because of their low conductivity, many times fracture when subjected to a rapid increase in temperature. The cracking of the mold not only is evidenced in a "fin" of gold upon the surface of the casting, but also results in an inlay of distorted dimensions. We have completely overcome this difficulty at the University of Nebraska since the sponge core was introduced into the casting technic.

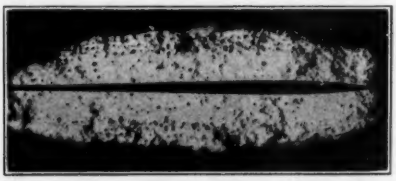


Fig. 12.—Cross-section showing air bubbles trapped in inner core when thin mix is used.

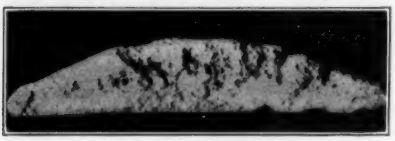


Fig. 13.—Cross-section showing absence of trapped air bubbles in inner core when thick mechanically spatulated mix is used.

If the gold is to fill the investment mold completely, it is necessary to provide some means for decreasing resistance to the escape of air. This is easily demonstrated by feeding molten gold into a pyrex tube which is sealed at one end and constricted at the center to a diameter which is comparable to that of a sprue pin. The gold invariably fails to seat itself in the sealed portion of the glass tube that lies beyond the constriction. But if the same portion of the glass tube is cut off and is replaced by a body of wax that will give a mold the walls of which will afford the necessary escape for air, the

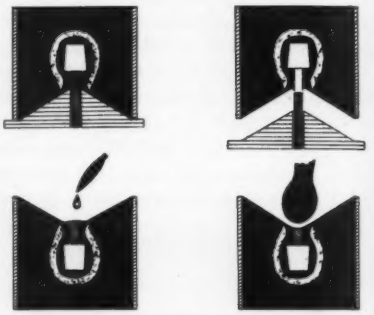


Fig. 14.—Above: Left: Invested case. Right: Removal of crucible former and pin. Below: Left: Filling sprue hole with wax. Right: Forming new crucible surface by use of vulcanite scrapers.

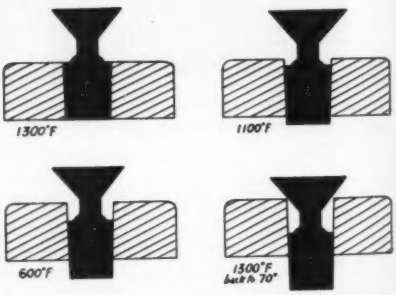


Fig. 15.—Gold plugs for 2 per cent tapered die, showing relative expansion at various degrees of temperature in heat treatment of investment.

molten metal can be seated perfectly. (Fig. 11.) Certainly the sponge core has its merits in making possible an immediate escape for the air in the investment mold. Through the courtesy of R. L. Coleman, formerly of the Bureau of Standards, I have received the apparatus that was used by the Bureau of Standards for determining the relative porosity of investment. A comparison of the tests on the escape of air through the one-eighth inch inner core of investment and through a mass of investment comparable in thickness and consistency to the one mix investment leads to a definite conclusion: It is more advantageous in the seating of gold in an investment mold to have an immediate escape for air by using a sponge core than to hold the escaping air under pressure as it is being forced into the body of a single investment.

The inlay ring is now properly fitted on the crucible former and made ready to receive the outer investment. As the outer investment is merely a framework to hold in place that which is within, the measuring, mixing and pouring of this investment are less important. For this mix, 2 level tablespoons of loose investment is added to the same amount of water. The mixture is spatulated with the hand spatula and poured down the side of the ring, the operator gently vibrating the mounted case to secure a proper crucible face and to avoid the trapping of large pockets of air. The poured up case is set aside for from twenty to thirty minutes, this depending on the thickness of the outer investment.

Some dentists, realizing that the water content of a thin mix of investment may be reduced if surrounded by a sponge core, insist on using a thinner investment for the inner core and pouring the same mix for the outer investment, instead of bothering to measure and spatulate two mixes of investment. But this short-cut is a grave mistake, for although it is possible to reduce the water content, the air bubbles that persist in a thinner mix, even after mechanical spatulation, cannot be withdrawn. Consequently, nodules appear on the surface of the gold casting, because the thin layer covering the small pockets of air that rest along the walls of investment breaks down when the metal is thrown into the mold. (Figs. 12-13.)

The small portion of sticky wax that was used to attach the sprue pin in the crucible former is removed, and the crucible former is separated from the inlay ring, the sprue pin being left imbedded in the investment. The removal of the sprue pin is facilitated by slight heating, which causes its release from the wax occupying the inner mold.

In the majority of cases, irregularities about the mouth of the sprue hole are found after the removal of the crucible former and sprue pin. If these jagged lips of investment are left, small portions may be fractured and carried into the mold by the inrushing gold. The bits of investment invariably will come to rest across an angle in the mold and thus the seating of gold be prevented along delicate margins. With one minute of time, a little wax and a vulcanite scraper, this catastrophe may be avoided. The sprue hole is filled with wax by the use of a narrow spatula, and a new crucible surface is formed by the use of the vulcanite scraper, a clean, rigid lip resulting about the opening to the sprue chamber. If any irregularities appear next to the inlay ring, an instrument should be used to remove them. (Fig. 14.) The burning out of the wax pattern and the heat treatment of the investment are of major importance; for, in this step, we take advantage of the most important factor in control, thermal expansion. To satisfy ourselves that the control may rest alone in the thermal expansion of the investment, a

series of 2 per cent taper wax plugs, uniformly invested, may be heat treated with a control furnace, the respective cases being held at 600, 1100 and 1300 F., to insure a positive reaction at those temperatures. When the cast plugs are placed in the die for which they are made, they decidedly show the stages in the thermal expansion of the investment. (Fig. 15.)

From the start, the increase in temperature must be gradual and not violent in order to accommodate the physical changes of the investment. Care must also be taken not to overheat the investment. Every technician has agreed that 1300 F. is the ideal temperature to cast when using high heat investments, but that to overheat and then to drop back to 1300 F. results in a considerable shrinkage of the investment mold.

The proper adjustment of the torch to facilitate the rapid melting of the gold will greatly reduce oxidation and segregation of the base metals. The extent of oxidation can be further lessened by the use of a flux that has an affinity for oxygen.

When a cherry red is visible through the sprue hole, a color indicative of 1300 F., the gold is preheated to forestall a cooling down of the case. While the gold is hot, the case is placed in the casting machine, and the metal is remelted and cast with a minimum amount of delay.

A BIOLOGIC-MATHEMATICAL FORMULA FOR AN IDEAL OCCLUSION*

By GEORGE H. MAXWELL, D.D.S., Chicago, Ill.

MY experience as an orthodontist has been very limited. To be exact, it consists of two cases, each of which resulted in a miserable failure. And it has been my misfortune to have those two failures appear at my office about twice a year for the past thirty years. From this little personal history, you will recognize that I am not here in a critical mood. I also wish to confess that, until a comparatively few years ago, most of my initial mouth examinations were what might be designated as "open mouth" examinations.

With such a history, it borders on the presumptuous for me to discuss the subject of occlusion. After I changed some of my tactics in connection with examinations and adopted a definite technic involving a careful survey of the occluding and nonoccluding tooth relationships throughout the functional ranges, observing, as I did, among other things, that various teeth were often wobbling, I believe that then I actually came to appreciate the facts underlying a statement that I had been making for many years —namely, that the occlusion of teeth, or rather the fundamentals underlying occlusion, whatever they might be, should constitute the operative basis of all comprehensive dental procedures.

The ultimate objective of dental research and practical endeavor of every kind is the preservation in health of all the component parts of the human masticating mechanism throughout the life

*Read before the Section on Orthodontia at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 18, 1936.

cycle, involving as it does (1) the work of the orthodontist, whereby a certain amount of assistance is given to nature in the growth and development of that mechanism toward the highest possible degree of functional efficiency, which, from the practical standpoint, is based primarily upon the arrangement of some of the component parts of that mechanism, and (2) the work of the other branches of the profession in the maintenance of that efficiency, both during development and after growth and development are completed.

Such a program is ambitious, and I am sure that an orthodontist is the only person who can appreciate the many difficulties encountered in the initial step of such a program. I am likewise sure that an orthodontist does not fully appreciate the difficulties in connection with the latter part of that program. It is unfortunate that the orthodontist is compelled, from the economic standpoint, to devote most of his time and energy to the correction of malocclusion. If half his time and thought could be devoted to those cases that need no treatment, greater progress might result. The general practitioner has a much better clinical opportunity to appreciate the advantages of a good occlusion than has the orthodontist; although it must be confessed that he has failed materially to take advantage of that opportunity, and the teeth are still being lost.

The situation today is healthful in that it indicates a cooperative spirit in connection with our common program and its ultimate objective. Hence, I, a general practitioner, am here to attempt to paint, or rather outline, an entirely new picture, a "blue print," if you will, of an ideal occlusion from a completely new perspective. This picture will not involve the well-known anatomic relationships in the form of cusp interdigitation, either functional or static, but will deal exclusively with the relationship which each of the individual enamel tissues of the mecha-

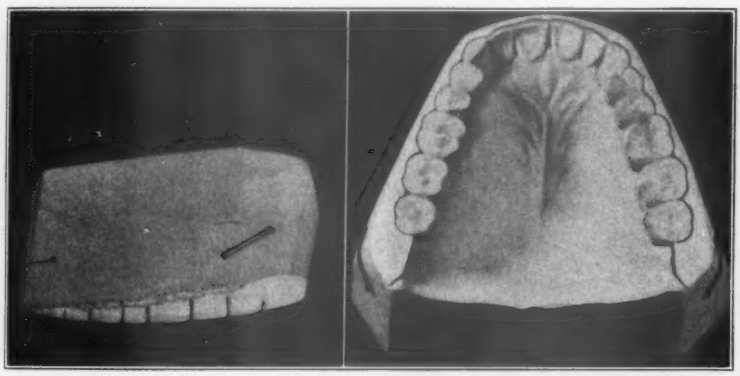


Fig. 1.—Left: Buccal view of maxillary part of incomplete mechanism embodying element of convexity. Right: Occlusal view. (The illustrations are photographs of plaster models, the individual tooth components of which are three times the average dimension of human teeth as submitted by G. V. Black. The models are the work of Mr. L. M. Farnum, and the photographs were made by Eric R. Lindholm. The spherical steel template shown in some of the illustrations has a curled edge and a long slot in it to permit slight intrusion of the lower anterior teeth.)

nism bears to each and every other enamel tissue of the mechanism, and their collective relationship.

I, as a general practitioner, can assure you that the destruction of peridental cell-life is the greatest problem, or obstacle, in the path to success in the latter part of the dental program. Therefore, it is evident that the secret of a successful culmination of our collective program must lie somewhere in the domain of the biologic sciences, with whatever assistance can be obtained through the physical sciences. Unfortunately for us, biology is still young in the ranks of the sciences, as is evidenced by the fact that in all of the various biologic working hypotheses,

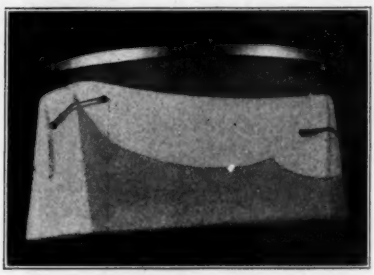


Fig. 2.—Buccal view of mandibular portion of mechanism embodying element of concavity.

there are but four major premises, or principles of life, upon which they all agree. Even considering this fact, those four principles give us a scientific basis upon which to predicate our mutual endeavors, in view of the fact that the destruction of cell life in the peridental structure is the worst enemy of our program.

I shall therefore briefly state those principles and shall attempt to determine what basis of operative procedure is most likely to lead to success. Briefly stated, these universally accepted biologic premises are as follows:

1. Each living unit is a pseudo-isolated system in dynamic equilibrium.
2. The most basic problems of life have to do with the catalytic, or contact action, mechanisms involved, and the ways in which specific syntheses are performed.
3. No organism lives in complete isolation from its environment.
4. Even in the simplest living thing, myriad molecules of great variety form different parts of the unit, which respond as a whole.

Concerning these last two principles, the biologist dwells at great length on "responding to stimuli in a way to main-

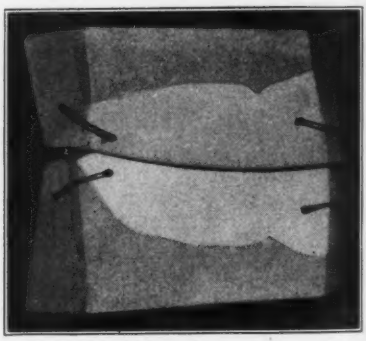


Fig. 3.—Buccal view of maxillary and mandibular portions of mechanism in contact, demonstrating elements of concentricity and congruency.

tain life" and "dying when unsuccessful in the attempt."

It seems to me that the secret of success of our program is revealed in the statement of these generalizations. I shall therefore offer a list of the salient features contained in these premises:

Life: Dynamic equilibrium; contact-action mechanism; specific syntheses; environment; response to stimuli, in a way to maintain life (health) or, when un-

successful in the attempt (disuse atrophy, trauma) death.

It is my purpose to reduce these broad generalizations as far as possible to our specific concern. It is a significant fact that the modern biologist lists every conceivable quality and character of a living organism, even to the consciousness and behavior of that organism, under the caption "the dynamics of living organisms." Please note that the first of the accepted principles states that each living unit is a pseudo-isolated system in dynamic equilibrium—a statement which carries with it the implication that if this dynamic equilibrium is disturbed or destroyed, the living unit suffers death. It would therefore appear logical that if we are to overcome our mutual enemy, cell death of peridental structure, we should base all of our endeavors upon the attainment and maintenance of a dynamic equilibrium, at least within the safety factor.

Reducing these broad generalizations to our specific concern, occlusion, requires the introduction of a specifically applicable terminology. Thus, dynamic equilibrium becomes an equitable division and distribution of masticatory force; contact-action mechanism becomes the functional occlusion of an enamel tissue system; while specific synthesis refers to the enamel contours and numerical growth and arrangement of the component enamel tissues, and not to the growth of the enamel tissues themselves. All of which can be summed up by stating that the primary objective of a study of occlusion is an understanding of the ecologic or environmental phases of peridental cell life or death.

The phrase "dynamic equilibrium" covers a multitude of sins, according to the biologist. He often refers to it as a physicochemical equilibrium, and the picture which I wish to paint (that is, the "blue print" of an ideal occlusion) is concerned with the first part of the combination; namely, the physical, but, nevertheless, a dynamic equilibrium in a narrower sense. The chemical phase and the physical phase of a dynamic equilibrium are equally interesting and important, from both the theoretical and the practical standpoints. From the standpoint of practical application, the science of physics is relatively much farther advanced than biologic chemistry, no doubt owing

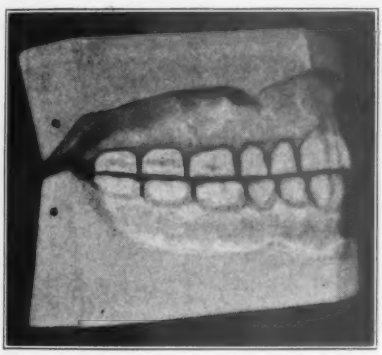


Fig. 4.—Maxillary and mandibular portions of mechanism showing next stage in development.

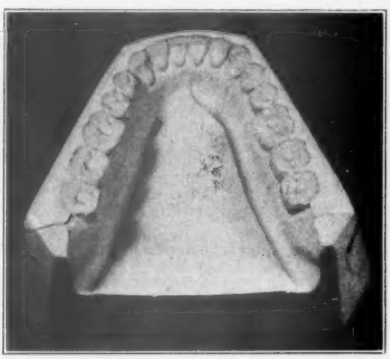


Fig. 5.—Small occlusal spillway carvings at fossae locations on bicuspids and molars.

to the fact that biology and chemistry, as sciences, are mere infants as compared to physics and mathematics. Owing to these circumstances, it is possible to attain a better comprehension of the physical phase of a dynamic equilibrium than of the chemical phase. In our present state of scientific progress, the chemical phase of growth and development undoubtedly is a source of more or less confusion and anxiety to orthodontists, as it is to other specialists of our profession, when growth and development have been attained. Since the two are inalterably linked, a more thorough knowledge of the physical phase, with the increase in skill which such knowledge entails, most

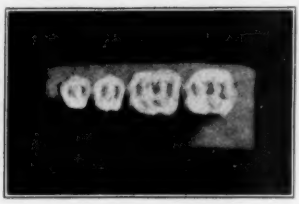


Fig. 6.—Occlusal perspective of enlarged spillways.

certainly will lessen the enormity of the task confronting us.

Biologic science deals with data accumulated on living organisms, and differs from the physical sciences in that, as yet, it is less subject to mathematical formulation. There is no line of demarcation separating the biologic from the physical sciences. Therefore, it is reasonable to suppose that, within certain limitations, mathematical formulation in the field of biology will become more pronounced as basic principles are brought to light.

In the field of higher mathematics, it has long since been definitely established that mathematics is the basis of symmetry, of form and of function, and as we delve into those mathematical generalizations and formulations, interpreting them in the terms of the one thing we know the most about, dentistry, some of our terms, such as bilateral symmetry, arch form and occlusal form, acquire a very decided mathematical significance. Of course, one can easily understand that certain other of our terms, such as curve of Spee, the line of occlusion, compensating curve and occlusal planes, have a mathematical basis, geometric it is true, but nevertheless mathematical. If we attempt to analyze the latter terms, particularly with reference to an exactness of application commensurate with mathe-

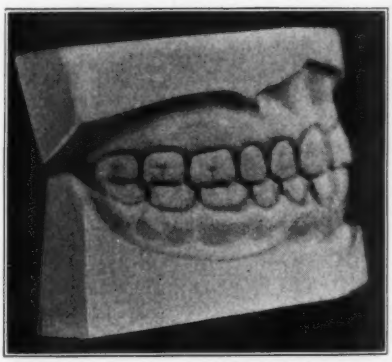


Fig. 7.—Completed mechanism; showing addition of cusps to stage of development shown in Figure 5.

matics, we encounter an indefiniteness that is anything but satisfying.

What I have to offer is, in a sense, a mathematical formulation of a specifically synthesized enamel tissue system, which is a portion of an occluding masticating mechanism, a mechanism that permits of a pressure stimuli environment of cell life in the peridental structures, wherein the essentials of a dynamic equilibrium prevail; in other words, a biologic mathematical formula of an ideal occlusion, a formula that is universally applicable, regardless of arch form, length or width,

height or inclination of cusps, size of teeth, deciduous or permanent, or any other variation of the normal occluding enamel tissue. The formula as stated contains the essential elements of the four principles of life universally accepted in biology.

I shall point out some of the highlights in application of such a formula. This working hypothesis is made up of forty-nine assumptions, one of which reads: "With a bilateral functional application, when a normal occlusion obtains, each and every tooth unit of the maxillary and mandibular dentures makes 'continuous occluding contact' with at least one, and no more than two, opposing units, throughout each and every functional occluding range of denture relationship." The basis of this statement and the necessity of such "continuous occluding contact" is the attainment of a dynamic equilibrium through the division and equitable distribution of masticatory force. Let me illustrate these physical essentials of a dynamic equilibrium in connection with the peridental cell life. We all agree that, generally speaking, the surface area of peridental membrane increases anteroposteriorly along the dental arch, and that gnathodynamometer tests show an analogous increase of applied masticatory force; which, of course, is occasioned by the mechanical advantage of the leverages involved. We should therefore expect to find the same magnitude of reactive pressure per unit of peridental area, regardless of position in the dental arch; that is, provided this "continuous occluding contact" of each and every opponent prevails throughout the functional ranges. Such a condition is in accordance with the thought expressed in the biologic generalization that specialization of structure and coordinating mechanism leading to more efficient living have resulted from forces acting on protoplasm.

The question is, therefore, what are the essential elements of such an occluding enamel mechanism? What specific arrangement or specific synthesis of enamel units will permit of this continuous occluding contact of all opponents during these functional ranges? What is the exact significance of the term cusp interference? Interference with what? In the final analysis, the answer to this last question must be interference with the division and equitable distribution of masticatory force, or with the dynamic equilibrium of peridental cell life.

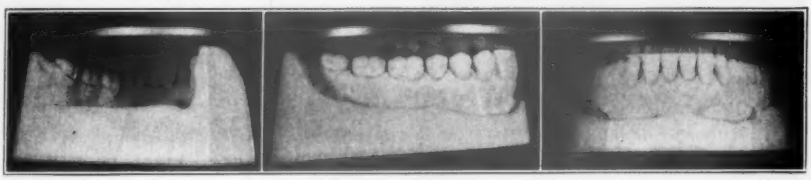


Fig. 8.—Left: Lingual view of mandibular portion of completed mechanism with spherical template in position. Center: Buccal view. Right: Labial view.

As it is much easier to understand an artificial mechanism than a living mechanism I shall attempt to illustrate the essentials of this living mechanism by constructing an analogous artificial mechanism that contains these dynamic features. This method of presentation was decided on as a result of the belief that abstract principles are more easily under-

stood if concrete illustrations of those principles are employed.

By a thorough investigation of the numerous and diversified ideas regarding occlusion, especially those ideas that have lived for some time, we are impressed with the thought of a curvature association with the normal arrangement of the enamel tissue. None of us individually has a "corner" on the truth in its entirety. The men who advanced these curvature association ideas were not subnormal intellectually. These various ideas of curvature association with tooth arrangement, when used alone or collectively, do not serve as a perfectly satis-

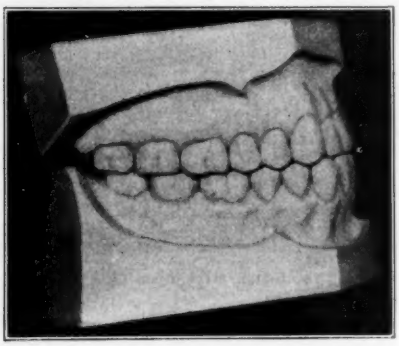


Fig. 9.—Completed mechanism in extreme functional protrusive relationship.

factory working hypothesis, in that all of the answers to the problems of occlusion are not supplied. There still seems to be some confusion present.

As a preliminary step to the actual experiment of constructing this artificial machine, I shall attempt to outline the abstract elements which are deemed to be essential to the success of the experiment. To be in keeping with the proposed analogy, it is perfectly obvious that our machine must consist of a fixed portion and a mobile portion. The term "fixed portion" is used advisedly, and is intended to be interpreted as "cranially fixed." I shall therefore designate the first two essentials as fixation and mobility. By the nature of things, these two essentials, from the standpoint of function, are inalterably linked, and also linked with a time-space element.

In our proposal to construct this artificial machine, which is to contain the operative essentials of a dynamic equilib-

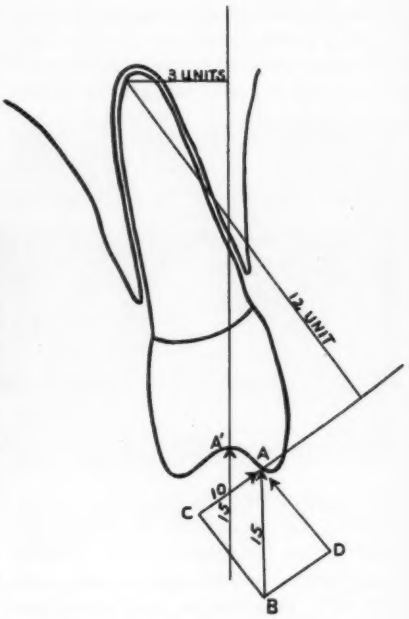


Fig. 10.—Resolution of a force into its component forces, angle of application and resultant torque or moment of force.

rium analogous to that of the living mechanism, by virtue of the fact that we are dealing with a three-dimensional affair, let us, as an experiment, decide on a regular curvature to be fashioned into our machine, if for no other reason than that curvature associated with a fixed center of curvature is more easily under-

stood than curvature associated with a moving center.

So I shall say that curvature is another essential element. The idea of regular curvature immediately suggests the elements of convexity and concavity (depending on the perspective). Take, for instance, the curve of Spee: the element of convexity (at least from the usual perspective, that is, from the buccal) is associated with the fixed or maxillary portion; whereas, the element of concavity must necessarily revert to the moving or mandibular portion of our mechanism.

Occlusion is officially defined, by the Committee on Nomenclature, as the contact of the maxillary and mandibular teeth during the functional ranges, a definition which clearly carries with it the implication of the "continuous occluding contact" of our dynamic assumption.

With the idea of occlusion or contact uppermost in our minds, and with the addition of the ideas of convexity and concavity, the further abstractions of concentricity and congruency immediately suggest themselves, by virtue of the fact that continuous contact of each and every opponent is an essential of the physical requirements of a dynamic equilibrium. These deductions give us six more essential elements: curvature, convexity, concavity, concentricity, congruency and contact.

In directing attention to the mobile portion of the machine, a question immediately arises as to the character of the motion. To begin with, there are but two kinds of motion; namely, rectilinear and angular. Our common observation and experience is that the motion, to be in keeping with the proposed analogy, cannot be one of a rectilinear or straight-line character. This deduction is substantiated by the perfectly obvious fact that whatever motion exists must be an angular motion, to be in keeping with the elements of concavity, convexity, concentricity, congruency and contact.

If we refresh our minds as to the exact significance and origin of the term "angular motion," it becomes perfectly obvious that a center of motion is a consideration from which there is no escape. We are concerned primarily with coordinating motion with the previously enumerated essentials, and especially with occlusion, that is, contact, as our foremost consideration.

The introduction of angular motion as a functional element of our experiment could easily lead to some very abstruse considerations, especially if the time-space element is allowed to enter. I shall therefore reduce this entire matter of motion to one of two-dimensional and three-dimensional movement, which shall be added to the outline: Motion-angular: two dimensional and three dimensional.

Since we are dealing with a three-dimensional object, and since angular motion, involving a time-space element, brings into the picture the questions of relativity, it is well to remember that a study of the motion of a point, or points, in space, instead of the motion of a three-dimensional object, will help to clarify any situation which arises; also, that when analyzing two-dimensional and three-dimensional movements, the motion should be broken down into its components. Thus, two-dimensional movement has either an anterior or posterior sagittal component, and either a superior or inferior vertical component. Three-dimensional movement, by the addition of either a right or a left horizontal component, naturally becomes more complicated. Incidentally, the median sagittal plane is the foundation upon which an analysis of the dimensional elements of movement must be based, since it is the one and only basic plane that can be ar-

bitrarily selected with impunity; that is, without introducing a premise of fallacious and empiric character, by virtue of the facts that (1) man, exteriorly at least, is a bilateral creature and (2) nature is subject to universal variation. The adoption of planes having arbitrarily selected anatomic landmarks as a basis of practical procedure is pure empiricism, and such adoption and practice are contraindicated by every accepted biologic tenet.

Therefore, for convenience and brevity, I shall incorporate the collective significance of concentricity, convexity, concavity, etc., into what I shall designate as the principle of spherical congruency, the mechanical, the geometric and the dynamic basis upon which our artificial machine is to be constructed as a concrete illustration of the basic principles upon which all of our collective operative procedures on the living mechanism are to be instituted, as a means to the end of attaining through the occlusion an equilibrium of force that meets the requirements of cell life, and as a means to maintaining a degree of equilibrium within the safety factor that permits of a response to stimuli in a way to maintain the cell life of the peridental structure. Disuse atrophy and trauma are our two worst enemies.

Up to this point, the larger part of this presentation has been of an abstract nature. In the field of science, "the rationalness of reality is implicity assumed" —abstract reality, such as intelligence, emotion, sphericity and congruency; and concrete reality, such as enamel tissue, physical contact, peridental cells and artificial and living machines.

That word emotion suggests that the term "spherical congruency" is so similar to the well-known term "spherical principle" that a danger exists. Every man of our research group can assure you that our conception of the geometric fundamentals of occlusion differs from Monson's spherical principle in all its numerous and diversified geometric details, not only in theoretical application, but also in its practical application, with the exception of one element. Furthermore, as the spokesman of our research group and with its official sanction, I can assure you that such conceptions as the curve of Spee, the compensating curve, the line of occlusion and the occlusal plane will take on an added significance, yet, at the same time, will disappear, not only from your thoughts but from your conversation, as soon as the principle of spherical congruency of contact relationship is thoroughly understood. The end-result of such a comprehension is a complete change, both objectively and subjectively, in the dental perspective.

Instead of constructing this artificial mechanism before your eyes, I shall first present different parts of an unfinished model, followed by the completed machine.

The unfinished model embodies three major stages of construction. The minor details are shown by photographs of models of the individual component units. Figure 1 is a photograph of the fixed or maxillary portion of the unfinished model, which embodies the element of convexity in the form of a horse-shoe-shaped segment, molded to a spherical template. Figure 2 shows the movable portion, embodying the element of concavity in the form of another horse-shoe-shaped spherical segment, likewise molded to a spherical template of equal radial dimension.

Placing these two spherical segments in contact or occlusion (Fig. 3), we find the elements of concentricity and congruency concretely demonstrated, in that the occluding surfaces are brought into mutual conformity, and have a common center of curvature, regardless of what-

ever occluding or contact relationship exists.

Moving one part of this machine upon the other in a contact relationship, in a backward and forward motion, and in a rotating sidewise motion, we see the functional elements of two-dimensional and three-dimensional motion concretely demonstrated.

Having done some quick and skilful carving, without changing the occlusion, we have a machine which begins to resemble the living machine (Fig. 4). From the occlusal aspect, the resemblance is decidedly negative. If small occlusal spillways which have the fossae locations on the bicuspids and molars are carved, as shown in Figure 5, the resemblance to natural teeth is slightly improved. Even with this added improvement, the masticating efficiency of such a machine would certainly be very slight. If these spillways are enlarged, as shown in Figure 6, on these small models, an occlusal aspect is attained which closely resembles that of the natural dentition, the spherical relationship having in no way been disturbed by the enlargement and modification of the spillways. It is evident that the dynamics of the situation remain unchanged, and that the principle of spherical congruency has been employed throughout the construction. It is also apparent that the masticating efficiency is not equal to that of a well-occluded set of human teeth. For instance, an analysis of the anterior functional area would show that, owing to the end-to-end relationship of the anterior teeth, an incising or shearing action would be impossible— that only a cutting or snipping action would be possible. An analysis of the lateral functional areas would reveal a high degree of mashing or grinding efficiency, with the spilling of the food directed largely toward the lingual aspect, owing to the location, contour and depth of the spillways, and the presence of spillways on the lingual periphery of these lateral functional areas. Any possible lack of efficiency apparently lies in what might be designated as the triturating element.

With a properly coordinated energizing adjunct, from the dynamic standpoint and from the standpoint of all-round efficiency, this machine would, it seems, be far superior to the majority of the living mechanisms with which we come in contact professionally.

Going back to the biologic generalization that specialization of structure and coordinating mechanism, leading to more efficient living, have resulted from forces acting on protoplasm, we find that the reference to efficiency and specialization of structure becomes rather interesting.

Specialized structure can here be interpreted simply as enamel tissue. It could have the further interpretation of enamel tissue contour. It seems to me that, for the orthodontist, the term enamel tissue contour would have great significance, if for no other reason than that the development of the individual and collective enamel tissue contour is the first complete anatomic development of all the functionally associated anatomic structures concerned with the occlusion of teeth, and that that development is complete at an early age and before occlusion, that is, function, takes place.

So let us continue our experiment, keeping in mind the dynamics of the situation, which require strict mechanical, geometric and physical adherence to the basis of our operative procedure; that is, the principle of spherical congruency. The question now is what change we can now make in the present mechanism which will afford the highest possible degree of masticating efficiency without disturbing in any way the physical aspects of the biologic requirements of a dynamic

equilibrium. Such an undertaking appears difficult, but the secret of success is found in that generalization which deals with specialization of structure, coordinating mechanism and more efficient living.

Looking this machine squarely in the face, from every angle, one is immediately struck by the lack of analogy to the living mechanism, owing to the absence of cusps, occluding enamel tissue contour, especially from the buccal aspect. The question immediately suggests itself: Can cusps be added to this mechanism at some such stage of the development as is shown on the model of development? Let us select the stage of construction which resulted from the introduction of the small spillways. It is obvious that we can build cusps upon these various small spherical segments, and it is also obvious that the present arrangement of spherical congruency with its dynamic features would be entirely destroyed.

I have attempted, through comparatively simple mental processes, to demonstrate the basic principles of an ideal occlusion, but the demonstrating mechanism is lacking at the present time in certain essential features, namely, cusp contours. We shall therefore add "cusp contour" to the outline of essentials.

For the purpose of concrete illustration, it is necessary to go back to the partially completed mechanism in order to introduce certain new technical terms and to demonstrate their meaning and theoretical and practical use. By placing a spherical template upon the mandibular portion of the mechanism, as shown in Figure 2, and examining its contact relationships, the significance of the term mandibular sphere is clearly demonstrated. By following the same procedure with the maxillary portion, the significance of the term maxillary sphere is likewise demonstrated. By placing the maxillary and mandibular portions in occlusion, or spherical contact, the significance of an important new term, namely, the contact occluding sphere, is also demonstrated. When the two portions are in occlusion, as shown in Figure 4, regardless of their functional relationship, it is obvious that the maxillary sphere, the mandibular sphere and the contact occluding sphere are identical, and also that when occlusion does not obtain, the contact-occluding sphere ceases to exist.

The landmarks of spherical application are the small spherical segments of the occluding surfaces, both posterior and anterior, and the geometric relationships of the occlusion are so simple as to need no elaboration.

Figure 7 shows the completed mechanism, which differs in no way from the incomplete mechanism except that cusps have been added at that stage of the construction, as shown by the introduction of the small spillways, which are analogous to the deeper portions of the fossae of the natural enamel. An examination of this completed mechanism, from the standpoint of bilateral incising action and unilateral triturating action, for bilateral possibilities of application leaves no doubt in one's mind that a high degree of masticating efficiency is made possible by the addition of the cusps. The question arises, Has the addition of the cusps destroyed the dynamic features? In other words, does the principle of spherical congruency still obtain?

An examination of this completed mechanism during functional movements analogous to the normal functional movements of the living mechanism reveals the "continuous occluding contact" upon which the dynamic premise is based; which, superficially at least, would indicate that the principle of spherical congruency still obtains. Probably, any clear-thinking person would hesitate to give the

question before us an affirmative answer on such scanty evidence, but would wish to know something definite about the character of the added cusps.

The language of true science is very exact; that is, the nomenclature; for instance, horse power, tangent, momentum and inertia. Many dental terms, such as cusps, occlusal planes and occlusal surfaces, as used, cannot and do not qualify as scientific nomenclature. For instance, the term occlusal surface clearly implies a surface that occludes; yet, as we all know, lingual, buccal and labial surfaces are occluding surfaces.

If there is any mystery about occlusion, that mystery is definitely associated with the unscientific term cusp. A solution of that mystery, if a solution is possible, lies in an undertsanding of a common character of the cusps which we have added to complete the mechanism. We use the term frustum cusp, but time prohibits a detailed explanation. We have added what we designate as the geometric or functional cusps to what we designate as the frustum of the anatomic cusps. These added cusps increase in height posteroanteriorly. The increase in height is directly proportional to the distance from the opening axis of the mandible, and is in perfect consonance with the differentials associated with the vertical component of two dimensional mandibular movement.

Let us first examine the mandibular portion of this completed mechanism with respect to the arrangement of the occluding enamel contour. Figure 8 shows the same spherical template placed upon the mandibular portion.

A careful examination will reveal that there are thirty-eight landmarks of spherical application, thirty-two of which are the tips of the cusps of the molars and bicuspids. Six of these thirty-eight landmarks are located on the anterior teeth, and although apparently the anatomic location is not so definite as with the other thirty-two, these landmarks are very definite in that they occur on the labial surfaces, slightly below the incisal edges and the cusp tip of the cuspids, at the position of occluding contact when centric occlusion obtains. Hence the necessity for a hole in the template. The lingual cusp tips of the bicuspids do not touch the template, and all cusps which do not reach the template are designated as minor cusps. Six of the thirty-two major cusps are variables, in that these six, namely the mesiolingual cusps of the molars, can either fail to reach the template, touch the template or protrude through the template. The twenty-six remaining major cusps are constants of the spherical relationship. The minor cusps, that is, the lingual cusps of the bicuspids, are all variables in degree of approach to the template. The lingual cusps of the second bicuspids, although variables in some instances, actually reach the template.

These variables, both major and minor, are in strict keeping with the implications of the biologic term "natural variation." These constants are also in strict keeping with natural variation, in that a cusp tip is a cusp tip, a point, and the infinite and universal variation in connection with that point is in the physiologic gradients of the enamel contours, which terminate at a point and not in the point itself.

The constants are also in strict keeping with the biologic and mechanical requirements of a dynamic equilibrium, a coordinating mechanism and more efficient living, with whatever interpretation one may logically make of the latter phrase.

These variable and constant spherical relationships of the mandibular denture have an important practical significance to the orthodontist, in that the possibility of substituting exact measurement for

guesswork or rule of thumb procedure is clearly indicated.

Now with these constants and variables of spherical application definitely indicated, we shall occlude the completed mandibular portion with the completed maxillary portion of the mechanism (Fig. 7). The points of occluding contact which these indicated constants make at centric occlusion on the maxillary denture lie on the surface of the contact occluding sphere, which of necessity is identical with the mandibular sphere at this denture relationship. As in the partially completed mechanism, we now have a mandibular sphere and a contact occluding sphere, but as yet no maxillary sphere. However, we have investigated but one denture relationship: namely, centric occlusion.

It is obvious that there is an almost infinite number of contact relationships, if this "continuous occluding contact" about which we have spoken really obtains during the two-dimensional and three-dimensional ranges, including the extremes of functional range. One should bear in mind that one-half the extremes of functional ranges is a common extreme, namely, centric relationship.

Two-dimensional movement is naturally easier to understand than three-dimensional movement. I shall therefore place the mechanism in the occluding denture relationship known as extreme functional protrusive, where it will be observed (Fig. 9) that the constants of the mandibular spherical relationship make contact, and therefore the contact occluding sphere of the centric relationship has disappeared, but it has reappeared at extreme functional protrusive. The positions of contact on the maxillary denture which the mandibular constants now make lie on the surface of the maxillary sphere, analogous to the one in the incompleted mechanism, the most obvious difference being the landmarks of application, which cannot be well shown by a photograph. It will be noted that these three spheres are of equal radial dimension, which is in conformity with spherical congruency. We therefore have in this extreme protrusive denture relationship a maxillary sphere, a mandibular sphere and a contact occluding sphere, in perfect conformity and hence identical in this relationship: that is, they are concentric.

Please note the difference in the geometric set-up of the unfinished and finished mechanisms. In the unfinished mechanism, the maxillary, mandibular and contact occluding spheres are identical in each and every possible occluding denture relationship; whereas, in the finished mechanism, the first denture relationship which I have demonstrated, that is, centric occlusion, shows that the mandibular and contact occluding spheres are identical; while, in the second relationship demonstrated, that is, functional protrusive, the maxillary, mandibular and contact occluding spheres are identical. It is evident that the contact sphere moves during the "continuous occluding contact" of the functional occluding ranges of occlusion, and that the maxillary and mandibular spheres have a constant fixed relationship to their respective dentures.

There is one way to study a known sphere that is moving around, and that is to know the location of its center, this knowledge making it possible to locate its surface. But the centers of these spheres are abstract considerations, having no definite anatomic locations or landmarks. The "natural variation" of the biologist prohibits such determination; and, furthermore, it would be of no practical use if we could give these centers definite anatomic locations. The location would not be tangible in a living

patient. However, we have established definite tangible, anatomic landmarks of spherical surface application which make it possible to determine definitely what the centers are doing when the mandible is moving.

I shall not take time to point out the definite anatomic landmarks of the maxillary sphere on the major cusps of the maxillary denture except to say that only six cusp tips qualify. There are six more variable minor cusps on the maxillary denture than on the mandibular denture, which makes a total of sixteen.

From a practical standpoint, to the orthodontist, with twenty-six cusp tips of the mandibular denture qualifying as constants, whereas but six of the maxillary denture so qualify, from the standpoint of facility of measurement, the mandibular denture assumes a position of great practical importance.

With only two occluding positions of the finished mechanism demonstrated, we have noted that the geometric set-up is entirely different from that of the geometrically simple unfinished mechanism. These two demonstrated positions are associated with a simple two-dimensional functional movement, and as the author of the working hypothesis under discussion, I should like to suggest that the spherical relationships occasioned by three-dimensional mandibular movement are a suitable subject for study in the peace and quiet of your home library. These geometric relationships are of but little importance in themselves. They are purely abstract considerations, but are of paramount importance when it comes to comprehending definitely that the principle of spherical congruency is the one and only possible curvature application compatible with the combination of tooth arrangement, "continuous occluding contact" and dynamic equilibrium; that is, where the operation of the mechanism in which curvature is embodied is a system of functional sequences of both occluding and nonoccluding relationships in which there is both a bilateral two-dimensional functional movement and a unilateral three-dimensional functional movement of bilateral possibility of application.

The foregoing statement is true regardless of the presence or absence of what we ordinarily designate as cusps on either a living or nonliving mechanism.

Basically, dentistry, including its many subdivisions, cannot be and should not be considered a true science until intelligent dental care can preserve man's teeth as an efficient and healthful masticating apparatus during life, regardless of the age; which state of being will never come about until dynamic laws become the operative basis of dental endeavor.

The most important dynamic consideration is that which is known as moments of force. A moment of force is the turning effect of a force, and is something entirely different from force itself. Two disastrous results of inordinate moments of force will be submitted to illustrate the imperative nature of equitable distribution, and hence of spherical congruency. These illustrations of moments of force apply to individual tooth units, singly or collectively. Formulated, a moment of force is the product of a force and its perpendicular distance from the fulcrum. Therefore, the full significance of the illustrations can be appreciated only by directing one's attention toward the prodigious arithmetical increase in the moment of force as compared to the slight increase in the magnitude of the force itself, as a cause and effect relationship.

Figure 10 illustrates graphically moments of force. The drawing represents an upper bicuspid and its peridental membrane and the surrounding alveolar

process. *A* is the point of application of an individual force occasioned by occluding contact with an opponent when the denture relationship known as extreme functional lateral occlusion exists.

Let us suppose, first, that the division and distribution of masticatory force is just and equitable, that is, that there is continuous occluding contact between each and every opponent; and, secondly, that the magnitude of the force applied at this point is one of fifteen units, the magnitude and direction of application being represented by the arrow *AB*. This force, being applied at an angle to the surface, is resolved into component forces. The one around which our interest now centers is represented both in direction and magnitude by the arrow *AC*. This force is at right angles to the surface and has, let us say, a magnitude of ten units. Its perpendicular distance from *F*, the selected fulcrum, is a distance of twelve units. The moment of force *AC*, or its turning effect on the lever, the tooth, is therefore represented by the figure 120.

Now, let the point *A'* be the point of application of the individual masticatory force when the relationship known as centric occlusion obtains. Let us suppose that the direction of application to the surface of the marginal ridge is at right angles to that surface and that the same magnitude of fifteen units prevails. This force being applied at right angles is not resolved into component forces, but in its effectiveness acts as a single force. Owing to the direction of this force, which does not coincide with the theoretical long axis of the tooth, or the lever which now prevails, the perpendicular distance from the fulcrum is one of three units, and hence the moment of this individual force is represented by the figure 45. We therefore see that the moment of force prevailing at lateral occlusion is much greater than at centric.

Now let us suppose that an unjust and inequitable distribution prevails; that is, that the cusp of this bicuspid interferes ever so slightly with the "continuous occluding contact" of opponents, and that the magnitude of the force applied at the point *A*, as a result of the inequitable distribution, is one of 75 units of force. Maintaining the same proportions, the force *AC* now has a magnitude of 50 units, and its moment is therefore represented by the figure 600. Now let us transfer our calculations to the point *A'*, and let us suppose that as this point is approached by the point of application during mandibular movement, the magnitude of force is reduced from one of 75 units to one of 15 units. We are justified in this assumption, owing to the fact that, in an occlusion which does not fulfil the requirements of a spherical congruency, or in malocclusion, even a fair degree of equitable distribution prevails in centric relationship. With this hypothetical basis of calculation, the moment of force at *A'* is 45. We therefore have comparative figures to illustrate the moments of force around which our concern centers. In the instance of equitable distribution, 120 represents the turning effect, and in the instance of inequitable distribution, 600 represents the turning effect. Comparatively, the turning effects are analogous to the turning effects on a house of a wind of 60 miles per hour and one of 300 miles per hour. Practically, the results are entirely different. Nothing happens in one instance; whereas, in the other, disaster results.

Now, before we proceed further, with the figures in mind, it seems logical to conclude (a conclusion substantiated by clinical evidence) that, in the first instance, the pressures engendered and the extensions of the peridental fibers, where

a moment of 120 pervails, are within the tolerable physiologic limits, and hence that health would prevail; and, in the second instance, the pressures and over-extensions which accompany a moment of 600 are beyond the limits of the safety factor and that continued trauma with blood coagulation must result, with its train of chronic inflammation, serumal deposits, infection and death. This is in conformity with our outline: response to stimuli—life and death.

Moments of force are thus demonstrated as a potentially destructive environmental factor of peridental cell life; a consideration which is not exactly an intimate concern of the orthodontist. Moments of force, as those moments obtain in the presence of inequitable distribution and the general plasticity of youth, are a vital concern to the orthodontist in that they are the means to the end of a nullification of a long-drawn-out and conscientious effort to render a true service. Arches do not simply collapse. Science has long since adopted the simple creed of the universality of the law of cause and effect. If there is any mystery as to the cause of the distressing migrations after the removal of retaining appliances, appreciation of the significance of the term moment of force clarifies that mystery. Force is a necessary accompaniment of function. The trouble arises from moments of unbalanced force, not force itself. Equitable distribution reduces moments of force to a tolerable minimum, and functional interdigitation introduces into an occlusion moments which are equal and opposite, and hence balanced. Neither equitable distribution, nor functional interdigitation, is possible except through the application of the principle of spherical congruency. If the case does not collapse after the removal of the retaining appliance, this circumstance cannot be accounted for by the long-continued presence of the appliance, but is due solely to the fact that an arrangement sufficiently near to the ideal exists whereby the kinetics of the system introduces turning effects, or action, toward a better arrangement.

The retaining appliance, in such instances, acts not as a retainer, but as a hindrance to better occlusion. The prize retaining appliance is the opposing denture, provided functional interdigitation is present and cusp tip approximation is absent. Cases which do not improve, and those which collapse, are far removed from spherical congruency with its balanced moments of force.

Scientific progress depends on strict adherence to facts of Nature. A human theory is comparatively without value unless confirmed by further observation and experimentation. If there is any validity to the claims enunciated, confirmatory evidence must necessarily be found in the phylogenetic tree to which man belongs. The science of biology demands such findings.

Many jaunts have been made into the fields of comparative dental anatomy, studying evidence both for and against this theory of spherical congruency in its application to the masticating mechanism of man's relatives. Wherever three-dimensional functional movement is found, spherical congruency is always found. Numerous and diversified spherical applications have been encountered and analyzed; in other words, the geometric "set-ups" range from those which are very simple to those which are very complicated, but none more complicated than that of man himself, no doubt owing to the fact that man is a very specialized and highly integrated creature. It has been my observation that in practically every individual instance observed in what are designated as the lower animals, the nearness of the approach toward the specific

geometric ideal is startling as compared to that which we are accustomed to in man himself. This tends to confirm Gilbert's observation that "Man is nature's worst mistake"; a statement with which I heartily agree.

I have attempted to explain in part the application of the principle of spherical congruency to man's masticating apparatus. Furthermore, I have demonstrated that application on a nonliving machine, having (1) occluding surfaces which are entirely cuspless, that is, of a spherical segment contour; (2) occluding surfaces with a cusp and spillway contour, which we have designated as frustum cusps, a contour which is frequently called "cuspless" and which is also frequently found in man's relatives, and (3) occluding surfaces of the normal anatomic cusp contour of man himself.

CONCLUSION

An ideal occlusion presupposes and requires: (1) normally developed coronal contours of properly coordinated mesiodistal and buccolingual dimension; (2) normally developed tooth and osseous, muscular and other anatomic and energizing structures; (3) a definite geometric and anatomic, individual and collective relationship of denture units, and (4) a definite geometric and anatomic relationship of the two denture units, and a definite correlation of the two dentures, cranium and mandible.

Such an occlusion permits: (1) full functional ranges; (2) the highest possible degree of functional mechanical efficiency; (3) an equitable distribution of force; that is, a dynamic equilibrium in its major aspect to peridental cell life; (4) the stimulating effect of normal function on growth and development as the numerical increase of the component units takes place; (5) the highest possible degree of esthetics of symmetry and form, and (6), last but not least, from the practical standpoint of the orthodontist, a dynamic equilibrium from the major anatomic aspect of a static arrangement of the teeth.

These qualitative factors of an ideal occlusion are interdependent; that is, one cannot exist without the others; and whatever degree of deviation from this geometric ideal prevails, a proportional decrease in the excellence of these qualities likewise prevails.

The primary concern or aim of the orthodontist should be functional ranges, owing to the fact that as the numerical increase of the tooth units takes place, if there is no cusp interference with the full functional ranges, a congruent spherical relationship must necessarily result, by virtue of the law of dynamics, which says that if under the action of a force between two parts of a system of bodies, a motion is produced, the direction of the displacement is in the direction of the force. In other words, nature herself produces the congruent spherical relationship, provided there is no interference with function. It is therefore evident that a bilateral spherical congruency can result only from bilateral function. There can be no bilateral functional efficiency without the arrangement described. Hence, spherical templates can serve as a check or measuring instrument for the arrangement of the individual units of each separate denture, while anatomic relationships can serve as a check on the upper and lower denture relationship. It is therefore evident that interdenture cusp relationships cannot serve as a guide to the individual relationships of the teeth of the separate dentures.

This theory of an ideal occlusion, concerned primarily as it is with the ecologic phases of occlusion, and dealing as it does with the contact relationships during functional activity, and the formula, as

partially submitted, describing as it does certain required arrangements of the component tooth units, taken collectively, is an interpretation of a cause and effect relationship. As already stated, this interpretation is in strict keeping with certain laws of dynamics. The formula itself is concerned only with the effect of relationships, and is purely descriptive. It therefore has a practical value which embodies the descriptive terms maxillary sphere, mandibular sphere and contact-occluding sphere, but this latter only as it applies at the extremes of functional occluding ranges. All of which is purely objective in application, and which has been summed up and designated as the physical essentials of spherical congruency.

A consideration of the contact relationships of this system of enamel entities, as those ever-changing contact relationships obtain during the intermediate stages of functional ranges, is also purely objective, but from a descriptive standpoint such a consideration presents many complexities. Therefore, the contact occluding sphere, taken as a whole, can best be handled when treated subjectively.

The practical phase of this working hypothesis is well within the bounds of experimentation and execution, and can be and has been entirely removed from the speculative realm. The subjective phase, in itself a pure abstraction, deals with the intuitive truths associated with the cause and effect relationships under consideration. In order to make intelligible the method involved between the cause and effect relationship, the descriptive term contact occluding sphere has been introduced, with a clear recognition of its inadequacy from the standpoint of geometric accuracy, but not from the standpoints of the distribution of force and of motion. Therefore, an attempt has been made to portray the contact actions and, at the same time, demonstrate the shortcomings of this term, a portrayal which in no way destroys the validity of the claims concerning forces and motion enunciated by the use of an insufficient term, in that the intimate physical details of the method of attaining and maintaining a dynamic equilibrium are described.

An attempt to describe with exactness, both objectively and subjectively, the contact relationships involved, brings into the picture what might be designated a "living" character, in that (1) the action of the all-inclusive contact action mechanism involved is analogous to the "breathing" action of the vacuoles of the living cell; or, to express it in a different manner, (2) the element of sphericity from the standpoint of the ultimate in accuracy of geometric abstraction is in itself variable; a theory which, from the standpoint of concrete visualization, can be resolved into "a sphere, upon the surface of which, and at the segments of which, application is made, a 'rippling,' or undulation, appears and disappears, intermediate to the extremes of functional excursions, the remaining portion of the surface of the sphere retaining its inherent nature during these intermediate relationships"—a perfect sphericity accruing at the extremes of functional relationship.

An attempt at description of this subjective phase has been made, but the context is not available at the present time. These abstract phases are of no practical importance; but the description (or rather the mental processes involved in a recognition of the intuitive truths concerned) is necessary to understand and appreciate the validity of the claims embodied in the theory, taken as a whole.

The working hypothesis has a biologic basis. The treatise which attempts to ex-

plain that hypothesis deals with the physical phases of a dynamic equilibrium. The subject matter is confined almost exclusively to a description of the contact relationships of an ideal occlusion. Such a description requires the terminology of spherical geometry, and includes a description not only of the variables, but also of the constants of the one and only possible variable arrangement of human teeth that gives to an occlusion those qualities which, taken collectively, constitute an ideal—a standard of excellence toward which to strive even though we realize that the geometric exactness of the ultimate objective is far beyond the reach not only of man's intellectual effort, but also of Nature herself, in that she in no instance follows exact laws as propounded by man.

DIAGNOSIS AND RECONSTRUCTION TECHNIC FOR THE TREATMENT OF INTERARTICULAR AND PERIDENTAL TRAUMA AND DISUSE ATROPHY*

By KENNETH A. BIGNELL, D.D.S., Chicago, Ill.

THE prevention and treatment of peridental trauma and disuse atrophy by obtaining functional occlusion, coupled, when necessary, with opening of the bite to relieve interarticular trauma, is a goal toward which thinking dentists have striven with varying degrees of success for a number of years. This subject is of equal importance to the periodontist, the prosthodontist and the reconstructionist.

Dr. Maxwell has presented his theory,[1] outlining the dynamic and geometric requisites of an ideal occlusion. This theory, which is based on definite dynamic laws and spherical principles, propounds a formula for the variable arrangement of natural teeth assuring an occlusion in which each and every tooth in the maxillary and mandibular dentures receive and carry an equitable load during the various occluding functional ranges of mandibular movement. Undoubtedly, this ideal occlusion does not exist in the human race, but only through a comprehensive understanding of what constitutes the ideal can we hope to approach it.

This subject has been treated in detail by Dr. Maxwell in a brochure that is available to those who are interested from the standpoint of research and study. The object of *this* paper is to show the most practical method of applying to reconstructions the principles enunciated. It would be well first to consider trauma from the standpoint of cause and effect, because a knowledge of the etiology and symptomatology is vital to a determination of the treatment to be applied.

Trauma, by definition, implies injury resulting from violence. Inequitable distribution of force, as a result of cusp interference, is the primary cause of injury to the supporting structures of the teeth.

Figure 1 is a schematic drawing demon-

*Read before the Section on Full Mouth Reconstruction at the Seventy-Second Annual Midwinter Clinic of the Chicago Dental Society, Feb. 19, 1936.

1. Maxwell, George H.: Biologic-Mathematical Formula for Ideal Occlusion, J.A.D.A. and D. Cos., 24:238 (Feb.), 1937.

strating equitable distribution of force. The rectangular figures, designated by letters, represent the upper and lower posterior teeth, supported by springs, which indicate the peridental membranes. *A* denotes the temporomandibular joint, and the masticatory force is shown by the large coil spring having a total occluding pull of 200 units of force when all springs are equally operative. When the rectangles come into apposition simultaneously, the coil spring pull of 200 units (effective by occlusion) is absorbed by the ten small springs in decreasing proportion postero-anteriorly, in amounts represented by the numerals below the rectangles. This diagram portrays the ideal condition of equitable division and distribution of force that should exist in the mouth in and during the functional ranges of occlusion.

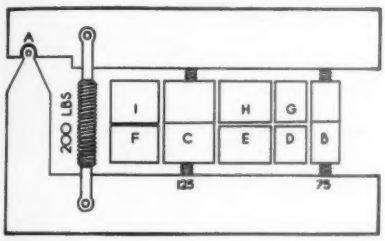


Fig. 1.—Schematic drawing showing inequitable distribution of force on posterior teeth.

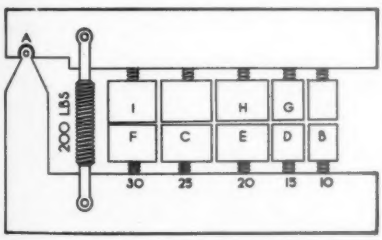


Fig. 2.—Schematic drawing showing equitable distribution of force on posterior teeth.

Insert at *B* and *C* two other rectangles of longer axial dimension (Fig. 2), and we have a condition analogous to cusp interference. The 200 effective units of force are distributed between four springs, 125 and 175 units per pair. One can readily conceive that such a distribution of force might not be within the tolerable limits of the four springs; a condition analogous to the violence and resultant trauma which prevail in the peridental structures when an unjustifiable and inequitable distribution of force maintains. This drawing also shows the conditions analogous to those associated with disuse atrophy in that the rectangles *DG, EH* and *FI,* representing teeth, are unable to make occluding contact and, hence, cannot function in the various ranges, owing to cusp interference. Therefore, the successful treatment of peridental trauma

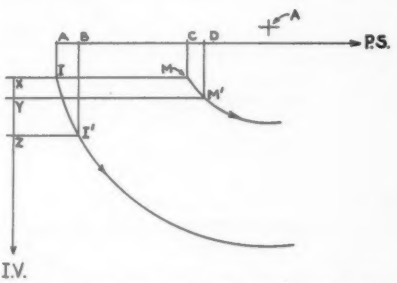


Fig. 3.—Schematic drawing illustrating differentials in two dimensional motion.

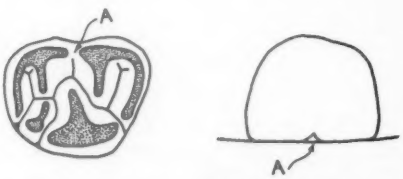


Fig. 4.—Buccal and occlusal perspective of frustum cusp upper molar showing spillways (white area) and spherical occluding segments (dotted area).

should have as its goal the elimination of this interference.

Interarticular trauma, resulting from intolerable forces which often accompany a lack or loss of vertical dimension of the face, is a subject that has been covered quite thoroughly in the literature by Monson and Bird, and more recently by Cosden, Wright, Goodfriend and others. No attempt will be made to discuss the histopathology of this condition or to go into the anatomy of this region, but it is

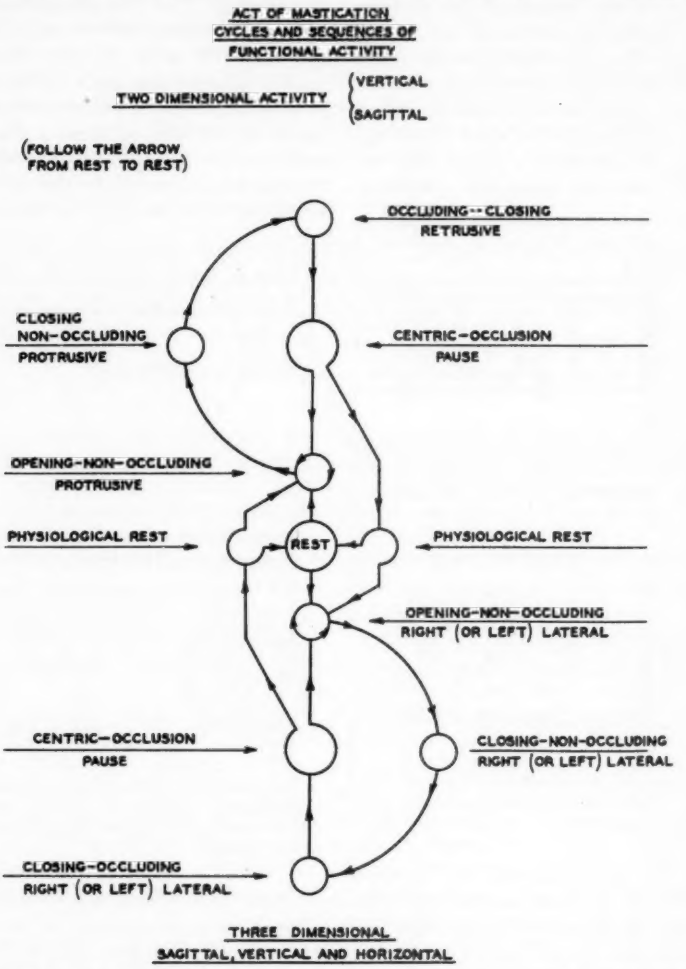


Fig. 5.—Drawing showing three distinct cycles of mandibular movements possible during act of mastication.

necessary to review the symptomatology as a definite adjunct to examination and diagnosis.

The local symptoms may be evidenced by pain and crackling noises during mandibular movement. These noises, while they are heard primarily by the patient, are in the more advanced cases audible to others.

The reflex symptoms are impaired hearing, dizziness, in varying degrees of severity, headache localized in the occipital region or behind the ears, or in the lower part of the mastoid region; dull pain in and about the ears, the patient complaining of stuffiness, burning and raw sensations on the sides of the tongue, and tenderness to palpation of the condylar joints.

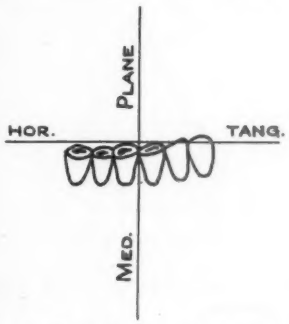


Fig. 6.—Charted horizontal tangency of lower anterior teeth.

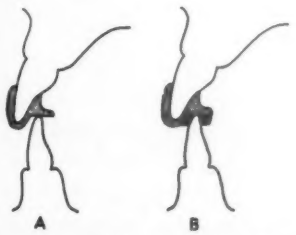


Fig. 7.—Cross-section of anterior bite guides.

The objective of the reconstruction technic to be offered is the nearest possible approach to the equitable division and distribution of force that obtains in normal occlusion and that accrues as a result of function wherein "each and every individual tooth unit of the maxillary and mandibular dentures makes continuous occluding contact with at least one, and no more than two, opposing units throughout every functional occluding range of denture relationship." The latter statement must necessarily be given a bilateral functional interpretation, and naturally such a premise applies specifically to a mouth that has a full complement of natural teeth. This reconstruction objective can be reached only by the application of the geometric elements which, taken collectively, have been designated as the principle of spherical congruency of occluding or contact relationships. The loss of teeth, which necessitates the placing

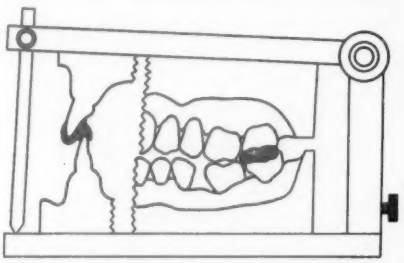


Fig. 8.—Method of securing open position registration by using anterior bite guide and small piece of wax placed well distally between posterior teeth.

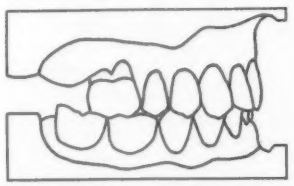


Fig. 9.—Buccal perspective of case successfully treated. (Compare Figures 10-11.)

of bridges or partial dentures, especially those with distal extensions, may make it impossible to secure such equitable treatment from the standpoint of the individual tooth units. In such instances, the application of this principle achieves the fairest collective treatment.

This technic does not require the use of mechanical articulators in a functional sense, either in making a diagnosis or in accomplishing complete reconstruction. No instrument is known that will reproduce individual mandibular movement; nor has it been demonstrated that models

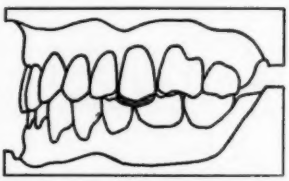


Fig. 10.—Case referred to in Figure 9; right side.

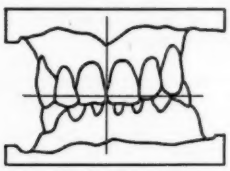


Fig. 11.—Frontal view of case referred to in Figures 9-10.

can be mounted to a correct opening axis. Therefore, to attempt to open a bite on an instrument is bound to necessitate final adjustments and corrections in the mouth after the cases are completed.

The primary concern of the reconstructionist or the periodontist is the occlusion of teeth during function and, if the movement of the mandible during the various occluding functional ranges is analyzed, it becomes evident that the arrangement of the teeth, with their varying cusp heights and angles, is the chief factor in the control of mandibular movement, the condylar influence being secondary.

To emphasize this point, consider an edentulous mouth. The mandible can move freely within the range of the physical limitations of the condyles, but, when full dentures are inserted, the functional occluding ranges are determined primarily by the arrangement of the teeth in those dentures.

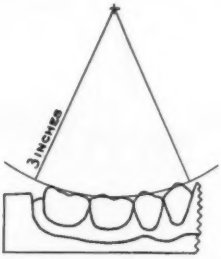


Fig. 12.—Adaptation of 3-inch radius to lower right side.

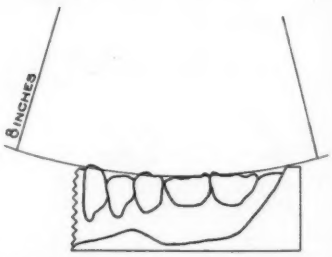


Fig. 13.—Adaptation of 8-inch radius to left side.

The method which is used in taking a bite in these edentulous cases is really that of securing an open position registration, the importance of retaining which is evidenced by the general use of pinstops on articulators.

The location of the opening axis has been a subject of considerable controversy. Various landmarks have been suggested

for facebow transfer technics, such as the anterior or posterior border of the condyle, its center or a definite distance in some indefinite directions from one of these, or some other point on the condyles. These various landmarks are neither tangible nor definite, because the condyles are covered with tissues of varying thickness and their size and shape cannot be accurately determined. The condyles travel forward and downward in an angular opening movement, and a careful analysis should convince one that the opening axis is well removed from the condyle head, but because of individual variation in the anatomic construction of the articular joint, the location of this axis is quite variable.

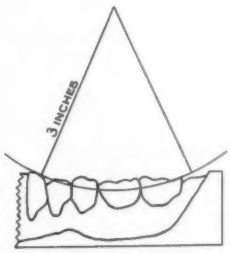


Fig. 14.—Impractical use of 3-inch radius on left side.

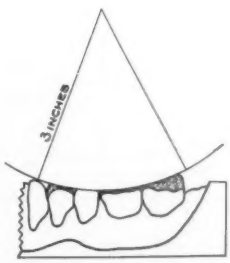


Fig. 15.—Impractical use of 3-inch radius on left side.

Since all mandibular movement is angular instead of rectilinear, in all bite opening procedures the angular movement of occluding contact positions on the mandibular teeth creates a problem in differentials which must be considered in making a diagnosis and in the reconstruction.

The quality of individual case differentials which are responsible for the confusion associated with the opening axis and resulting from the use of occluding frames is illustrated in Figure 3.

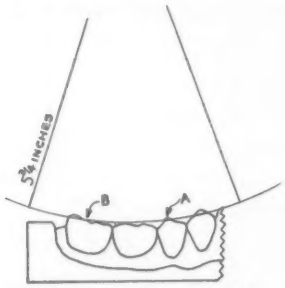


Fig. 16.—Compromise employing 5¾-inch radius.

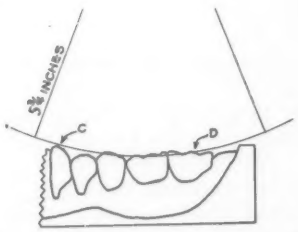


Fig. 17.—Compromise employing 5¾-inch radius.

M and *I* represent a molar and an incisor centric occluding contact position, respectively, on the mandibular denture. Opening movement takes place, *I* moving to *I'* and *M* to *M'*. *I* moves sagittally a distance equal to *AB* and vertically a distance equal to *XZ;* while *M*, in moving to *M'*, travels sagittally a distance equal to *CD* and vertically a distance equal to

XY. The relative amounts of travel are individualistic, because they are dependent on relative denture location and distance from the opening axis *A*. Hence, the term "differential" is used to denote the difference in two motions in the same direction. In this case, we have both sagittal and vertical differentials.

Because of the various movements that take place around the individual opening axis and rotating axis, an assortment of differentials prevail which cannot be controlled or coordinated unless individual axes can be accurately determined and maintained by the use of appropriate instruments.

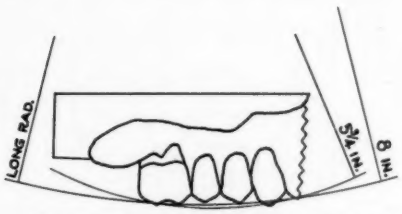


Fig. 18.—Compromise employing 5¾-inch radius in upper case.

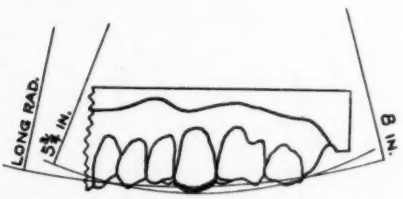


Fig. 19.—Compromise employing 5¾-inch radius in upper case.

To eliminate these various differentials, what has been termed an open position registration is obtained, the technic of securing which will be described later. The casts are mounted to a desired open relationship on a hinge and maintained at that position to the end that the finished reconstruction will insure this same amount of relative opening. The instrument that has been used by the group, a crescent articulator, was chosen because it is of simple construction with a sturdy anterior pinstop and bows that are interchangeable, and also because it is inexpensive. We have eliminated the functional mechanical features and use it as a simple hinge.

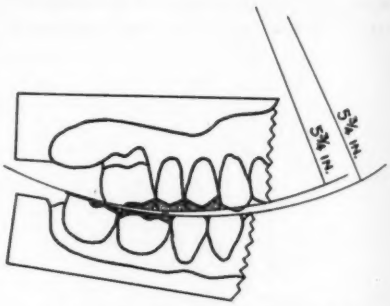


Fig. 20.—Posterior teeth conforming to 5¾-inch radius.

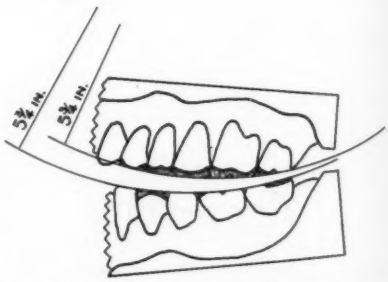


Fig. 21.—Posterior teeth conforming to 5¾-inch radius.

Balanced occlusion has become a hackneyed term, the interpretations of which have been as varied as the methods used in acquiring a pseudobalance. The technic to be offered is based on a strictly geometric concept whereby a spherical congruency of contact occluding relationships in its simplest form of application is secured.

Ideal anatomic cusp restorations would be desirable, but, because of malposition of teeth, which is very prevalent, any attempt to secure the combination of correct anatomic cusp contours and proper interdigitations, both buccolingual and mesiodistal, except in a negligible number of cases, must necessarily result in anatomic monstrosities with accompanying destructive leverages. Hence, there is ample justification for the use of the

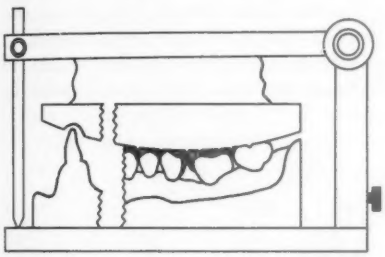


Fig. 22.—Mounting of stone templates to case.

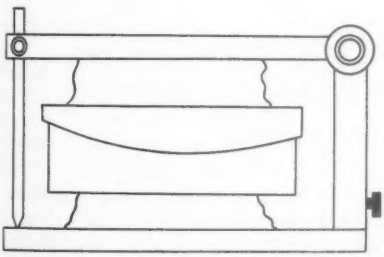


Fig. 23.—Mounting of stone templates to case.

frustum cusp type of occlusal surface, which was suggested by Dr. Maxwell to obviate these vexatious problems and at the same time insure equitable distribution of force. The carvings of Mr. L. M. Farnum demonstrating the frustum cusp tooth represent the ideal toward which we are striving. (Fig. 4.)

The contacting surfaces of teeth carved to these specifications are, in reality, small concentric spherical segments. Maxillary restorations can, therefore, be made to conform to the concave surface of a spherical template, and mandibular restorations can be made to conform to the convex surface of a spherical template. If these templates are of equal radial dimension, spherical congruency in the functional ranges can be obtained, with the result that cusp interference and the problems of interdigitation are eliminated and a dynamic equilibrium is secured.

The contact or occluding relationships of these frustum cusp teeth and normally contoured teeth must be of a spherical nature; otherwise, functional equilibrium

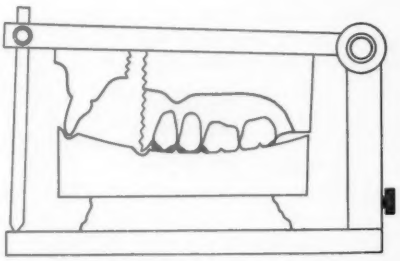


Fig. 24.—Mounting of stone templates to case.

cannot be achieved, since angular movement is involved.

The use of articulators is largely responsible for a diagnostic practice that is not in conformity with functional sequences as shown in Figure 5. Such practice is evidenced by the fact that in checking occlusion in the mouth, the usual policy of the operator is to instruct the patient to close to centric relation and then move the lower jaw to a lateral or protrusive position, an action which gives an erroneous picture of actual happenings, since it is the exact reverse of the functional movement that normally takes place in the human mechanism.

As shown in Figure 5, three distinct cycles of mandibular movements are possible during the act of mastication: a two dimensional movement that has a vertical and sagittal component, and two unilateral three-dimensional movements that have, in addition to these two components, a horizontal component.

It will be observed that functional movement is inaugurated at the physiologic rest position and that, in these various functional cycles, whether they are two-dimensional or three-dimensional, occluding contact does not commence until after the extreme protrusive or lateral range has been reached; after which, the mandible slides to a centric relationship.

As the next diagnostic step, a condyle meatus examination should be made. This examination is accomplished by placing the thumbs on the forehead and the ends of the little fingers in the external auditory meatus, after instructing the patient to open and close repeatedly to a centric relationship and through lateral ranges. If condyle retrusion is present, the relative amount should be noted. The relative amount of pain occasioned by a careful examination should also be recorded.

In this connection, it is suggested that condyle meatus examinations should be a routine procedure with all patients, to the end that such practice will make for better comparative diagnosis.

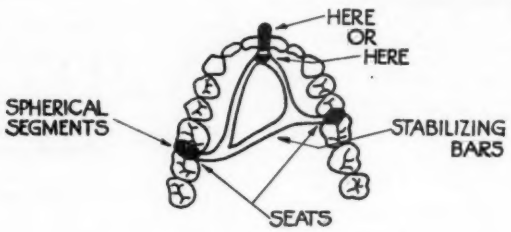


Fig. 25.—Type of template guide.

Only by observing the actual contact or lack of contact of the teeth as the functional cycle progresses can what really takes place be determined. Therefore, as the first step in a mouth examination, in the attempt to ascertain where cusp interference exists, the patient should be instructed to register the protrusive and lateral positions and then close and "slide" to centric. When this method is followed, the possibility of grinding teeth to eliminate trauma in cases that do not warrant the more radical procedure of complete reconstruction is clearly revealed.

The local and reflex symptoms of interarticular trauma, as stated earlier in this paper, should then be checked and recorded, being followed by a complete mouth examination in conjunction with full mouth roentgenograms and other modern diagnostic practices.

In order that the best esthetic results may be obtained, the anterior horizontal tangency must be noted. This term "anterior horizontal tangency" denotes, from the frontal aspect, the visual relationship of the six anterior teeth, upper and lower, to a line intersecting the median sagittal plane at right angles. This line is tangen-

tial to the mandibular sphere and touches the two lower central incisors. Figure 6 illustrates a charted horizontal tangency.

All cavities and fillings should be carefully recorded as to both location and size, because the remaining portion of the diagnosis will be made in the laboratory, when the patient is not present. Such recorded findings are imperative since they will materially assist in determining the amount of cutting of the teeth that is possible, and they also give a visual picture of the particular problem involved in building up other teeth.

The following steps are necessary to prepare for the laboratory phase of the diagnosis:

Accurate impressions of the upper and

SPHERICAL TEMPLATE GUIDE

Fig. 26.—Type of template guide.

lower dentures are secured and casts made in artificial stone. For the purpose of a preliminary survey, these casts can be mounted either in centric relationship on the instrument or in a slightly opened relationship, preferably the latter (on the basis of considerable experience in this work); in which case a bite to that end must be secured. In either event, the relative distance of the models from the opening axis of the instrument should correspond to that which exists in the patient, but since the natural opening axis cannot be definitely determined, whatever mounting is made constitutes a guess. Therefore, every consideration that tends to make a guess a good one should enter into this procedure. Guesswork cannot be tolerated except as a preliminary diagnostic step toward the final definite determination relative to the amount of opening necessary. A future step in the technic introduces a procedure that eliminates every consideration of opening the axis and the differentials of movement associated therewith. The purpose of the preliminary survey is to approximate the required opening in order that a bite guide may be constructed, as shown in Figure 7.

A small amount of wax is molded, as illustrated, and is cast in a low fusing technic metal. The surface engaging the incisal edge of the lower central incisors is flattened to permit free retrusive and protrusive movement of the mandible.

The bite guide is then placed in position on the upper central incisors and the patient instructed to close. (Fig. 7, *A*.)

The patient is instructed to open and close several times until the normal retruded position of the mandible is obtained. If contact is made on the metal surface, the retrusive location may be marked for future reference and should a surface of added modeling compound be used, a slight indentation will suffice *(B)*.

The desired amount of opening having thus been approximated, it is necessary to secure posterior supports for this opened registration in order that the casts can be remounted in exactly the same relationship on the laboratory instrument.

Two small pieces of hard wax, thoroughly heated, are held in position on each side of the posterior region of the dentures, and the patient is instructed to close gently until the lower anterior teeth engage the inferior surface of the bite guide.

It is imperative that the normal retruded relationship be obtained.

The two small posterior wax bites are then properly set on the lower cast. The

upper cast is removed from the upper bow of the instrument and, with the anterior bite guide in place, is set on the lower cast and replastered to the bow. (Fig. 8.) The anterior pin stop is securely locked. When the guide and bites are removed after the casts have been mounted in this definite opened relationship, the second step in laboratory diagnosis can be made. The preliminary diagnostic step and this second step are almost identical, the latter simply being a check on the former. One explanation will, therefore, suffice.

The radius and the location of the contact occluding sphere that will meet the requirements of the most equitable collective treatment of the teeth must be determined.

Among the problems that arise in this connection are the buccal, labial and lingual displacement of individual teeth or groups of teeth in the two arches, and the differentials that exist in the relationship of the occlusal periphery of the upper teeth to the lower because of the angular nature of the opening movement; a situation that is very evident in cases that require a great amount of opening.

The drawings of one case that has been successfully treated are shown in Figures 9-11.

A careful analysis shows that on the lower right side, the use of a 3-inch radius would necessitate the least amount of shortening or lengthening of these teeth. (Fig. 12.) On the left side, an 8-inch radius would best meet the requirements. (Fig. 13.)

Figures 14 and 15 demonstrate two possible results of using a 3-inch radius on the lower left side. Observe in Figure 15 the inequitable treatment of the second bicuspid and first molar as compared with the first bicuspid and the second molar. The same may be said of treatment (Fig. 14) which, in addition, is impractical because of the pulp involvement that would undoubtedly ensue.

Figures 16 and 17 show a compromise in the form of a 5¾-inch radius, the use of which would result in an equitable collective treatment of the mandibular denture. By the use of this radius, it is obvious that both grinding and lengthening are reduced to a minimum.

From Figures 18 and 19, it is apparent that the cusps of these teeth conform closely to a straight line; hence, proper treatment of the upper denture would require a very long radius; which is far from being compatible with an equitable treatment of the lower teeth. Since it is necessary to construct the upper and lower denture to an identical radius, 5¾ inches seemed to be the most nearly ideal for the case as a whole.

The method employed in the laboratory to arrive at the above-mentioned conclusion is comparatively simple. A roll of well-softened wax is placed on the occlusal surfaces of the teeth on each side of one cast and the spherical template selected is pressed into the desired position. The wax is chilled and the template removed. At this time, the wax should not be trimmed away to the buccal and lingual peripheries. The instrument on which this cast is mounted should then be closed; whereupon, it becomes apparent what treatment is required for the opposing denture if that surface location is to be employed.

If, at this stage of the diagnosis, a better position for surface location is suggested, the wax technic previously described can be carried out according to the latter decision.

This problem is sometimes involved because of the various factors that must be considered. It may be necessary to repeat the procedure several times, carefully analyzing the results obtained in each new relationship. When a practical location

has been determined by this method together with cautious trimming of the cusp tips here and there, the location of the contact occluding sphere which will meet the requirements for an equitable treatment of the case can be secured.

Cases requiring considerable opening often present buccal lingual relationships that can be improved by advancing the mandible. If one should decide to follow the latter procedure, it will be necessary to secure a new open position registration from the patient, as previously described, but to the desired advancement. Also, the upper cast must be remounted to the new registration and the anterior pin stop reset.

Figures 20 and 21 portray the result of the complete diagnosis of the case previously under discussion, made to a 5¾-inch radius, and showing very definitely where grinding or lengthening was necessary.

The problem now is to make it possible to transfer this diagnosis to the mouth and maintain the relationships that have been established, through reconstruction to the completed case.

A method will be shown whereby this is accomplished; for, once the diagnosis is accepted, no more bites are taken in the mouth, all being taken in the laboratory. By this method, the differentials resulting from the flexibility of the interarticular joint and angular motion are eliminated. Failure to recognize the importance of this fact can only lead to trouble for both dentist and patient.

With the anterior pinstop set, the upper bow of the instrument with the upper cast attached is removed and replaced by an empty one.

A convex stone template of 5¾-inch radius is placed on the lower cast (Fig. 22) and attached to the upper bow with plaster-of-Paris. The operator having made sure that the anterior pinstop is set to this relationship, the lower bow and cast are removed from the instrument and replaced with an empty one.

Now, with a little wax, a concave template of the same radius is attached to the one that is on the upper bow and this is plastered to the lower bow. (Fig. 23.) The sphere created by these two templates represents the contact occluding sphere to which the case is to be constructed. The mounted templates are interchangeable with the models, and it is now possible to construct a template guide that makes the accurate transfer of the diagnosis to the mouth possible.

The lower bow with template attached is assembled with the upper cast on the instrument. (Fig. 24.)

The wax, which was used in making the laboratory diagnosis, is removed from the upper cast and three widely spaced positions are selected where the occlusal surfaces have not been marred by cutting. (Figures 25 and 26.) A small piece of well-heated wax is placed at each of these selected locations and the instrument is closed until the anterior pinstop engages the lower platform. These segments should be small. They may rest on uncut occlusal surfaces or on an embrasure and should be trimmed, when possible, so that they are flush with the buccal surfaces of the teeth. These segments are connected by wax to insure stability and the wax form is removed from the cast, invested and poured or cast in low fusing technic metal.

By changing the bows on the instrument and replacing them with the lower cast and the template that is mounted to the upper bow, a similar process to the one just described is followed and a lower mouth template guide is made.

These two castings are checked three ways: as to correctness of adaptation to (1) their individual casts; (2) their individual templates, and (3) to each other.

The upper template guide is placed in

position in the mouth and the concave surface of a template of 5¾-inch radius is placed on the posterior teeth. High spots are relieved by grinding until the template can make three-point contact with the segments of the template guide. By use of the convex surface of a template, the same procedure is followed in the mandibular posterior teeth. Cusp interference in the new open position has been eliminated and the accuracy of the transfer of the open position registration can be definitely checked. Any error that might manifest itself at this stage would necessitate the taking of another open registration and remounting the casts. If the procedure has checked up to this point, a reconstruction compatible with the diagnosis can be obtained without resorting to bites taken in the mouth, provided new impressions and casts are made and mounted to bites taken on the templates in the laboratory.

The case that has been shown was made in the early days of the development of this technic. In using occlusal surfaces of the frustum cusp type, the importance of accurate spherical templates soon became apparent, and we were unable to find any on the market that measured up to the required standards. For some time, we were compelled to cut individual templates out of plaster-of-Paris. This was a tedious job and the finished product was not entirely satisfactory and was easily marred. We are now using unbreakable glass templates that were made to our specifications by an optical company. These spherical templates are correct to within one thousandth inch and are used as master templates from which the stone templates are secured.

This technic has been used by our group for some time now, with the most gratifying results. That peridental and interarticular trauma are conditions which are superinduced by malocclusion and that these conditions demand relief cannot be denied; but we view with considerable concern a growing tendency toward the use of radical procedures in the great majority of cases.

Judicious grinding to reduce cusp interference can accomplish much and is especially recommended in cases wherein there is no interarticular involvement. In certain cases, the removal and replacement of one or more teeth that are shown to be the chief cause of a malocclusion may make it possible to secure a satisfactory degree of functional occlusion without increasing the vertical dimension or undertaking a complete reconstruction.

In cases that do warrant the more radical procedure, only the least amount of opening that is compatible with the location of the contact occluding sphere and relief of the interarticular condition should be used.

Removable splints, which can be constructed quite simply after the laboratory diagnosis has been made, are a valuable adjunct in the confirmation of the diagnosis; but because of the danger of caries developing on the covered surfaces of the teeth, splints must be condemned as anything other than a temporary expedient.

We have no quarrel with men who may continue to favor anatomic cusp restorations in the reconstruction of cases. We believe that the field for this type of work is limited because of the various differentials that present themselves and, furthermore, that even in these limited cases only the most skilful operators and technicians can hope to obtain a satisfactory result. Individual tooth restoration employing anatomic cusp contours are very likely to introduce intolerable destructive movements of force, with resultant trauma greater than that which the reconstruction was intended to alleviate.

The method that has been described is

offered because of its comparative simplicity of application in the hands of the many, and I hope that you may have the same degree of satisfaction in the use of this technic that it has afforded us.

I fully recognize an inability to cover this subject thoroughly in a short time. The principles of Dr. Maxwell's theory lend themselves to universal application in dentistry, and the problems that arise are many. There is a great need for research and investigation in this field, and I hope that we may be favored with your criticism and help; for only through a spirit of cooperation can real progress be made.

25 East Washington Street.

REPORT OF THE RESEARCH COMMISSION OF THE AMERICAN DENTAL ASSOCIATION*

TO the officers, Board of Trustees and House of Delegates of the American Dental Association:

At the annual meeting of the American Dental Association held in New Orleans, La., Nov. 4-8, 1935, an appropriation in the amount of $13,000 was given to the Research Commission to cover grants and administrative expenses for the fiscal year beginning July 1, 1935 and ending June 30, 1936. In addition, sums of $500 and $250 were given respectively by the National Society of Denture Prosthesis and the American Full Denture Society for use in connection with Grant No. 1, American Dental Association Research Fellowship at the National Bureau of Standards. The Board of Trustees of the American Dental Association accepted these gifts at their midwinter meeting and placed the gifts in the general fund to be employed solely in connection with the study of denture base materials at the National Bureau of Standards.

The Research Commission allocated this fund as shown in Table 1.

The Chairman and Secretary of the Research Commission held two conferences during the fiscal year: one at Washington, D. C., and the other at Chicago during the Midwinter Clinic of the Chicago Dental Society, for the purpose of discussing the work of the Research Commission at the National Bureau of Standards, as well as the annual report and other business coming before the commission during the fiscal year.

*For the fiscal year July 1, 1935-June 30, 1936.

Grant No. 1: American Dental Association Research Fellowship, National Bureau of Standards, Washington, D. C.

The Research Commission assumed the obligation of the fellowship in the National Bureau of Standards in 1928 and has continued it to date in cooperation with the federal government.

The commission believes that this study of materials used in restorative dentistry under the auspices of this fellowship is one of the outstanding activities of the American Dental Association. Judging from the inquiries which the Secretary's office has received, the profession shares this belief and is actively assisting the commission in accomplishing its program of standardizing and improving dental materials.

This fiscal year, the federal appropriation for this work was approximately $4,500. In reality, the government aug-

ments this sum greatly, since it furnishes office and laboratory space and permits the use of its scientific instruments. In addition to the assignment of Wilmer Souder (physicist) and I. C. Schoonover (chemist) specifically to the research on dental materials, the staff of the bureau is available for consultation.

The commission employs three full-time research associates; a dentist, a physicist and a mechanical engineer. These men are stationed at the bureau and are subject to the same regulations as are the bureau's staff.

OUTLINE OF WORK

Research.—The major research work this year has been on silicate cement and denture base material. The silicate cement report is practically completed, while that on denture base materials is still in progress. Both of these reports will be presented at the annual meeting of the American Dental Association.

Testing.—Our research associates at the National Bureau of Standards test all materials which are certified to the Research Commission by the manufacturers as complying with the American Dental Association specifications, to determine whether the manufacturer's certificate is acceptable to the commission. If the material is found to be as guaranteed, its trade name is listed in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION. From time to time, materials on this list are retested. If any product fails to pass the rigid requirements of the specification, it is omitted from the list. Any product thus deleted may be recertified to the commission by the manufacturer and if found acceptable on retesting, will be added to the list at the next printing. This program requires a considerable amount of testing, but it is a practical way of controlling the quality of materials. One research associate spends practically his entire time on this phase of the work, which also demands many hours of time of the other two associates. Dental materials must be regularly tested if the plan of protecting the dentist in purchasing is to be effective.

TABLE 1.—ALLOCATION OF RESEARCH APPROPRIATION

1. American Dental Association Research Fellowship at the National Bureau of Standards	$10,500
2. University of Louisville	750
3. New York Institute of Clinical Oral Pathology, Inc.	750
4. College of Physicians and Surgeons	250
5. Executive Board	500
6. Secretary's Office	250
Total	$13,000

LIST OF CERTIFIED PRODUCTS, 1935-1936

The list of certified products, 1935-1936, is a revised list of dental materials that have been certified to the Research Commission by the respective manufacturers as complying with American Dental Association specifications. This list will be revised from time to time as new certifications are received or as materials are checked for compliance with specifications.

CERTIFIED AMALGAM ALLOYS A.D.A. SPECIFICATION NO. 1[1]

Samples of all amalgam alloys certified to the Research Commission of the Amer-

1. Paffenbarger, G. C., and Sweeney, W. T.: Specifications and Certifications for Dental Materials, J.A.D.A., 21:658 (April) 1934.

TABLE 2.—FOURTH SURVEY OF ALLOYS
(May 4, 1935)

Alloy	Manufacturer or Distributor
Accurate Metalloy (Filings)	The L. D. Caulk Co.
Ackerman (Filings)	Ackerman Dental Mfg. Co.
Argentum (Shavings)	Hammond Dental Mfg. Co.
Argentum (Filings "A" Cut)	Hammond Dental Mfg. Co.
Argentum (Filings, Medium Cut)	Hammond Dental Mfg. Co.
Argentum (Filings, Fine Cut)	Hammond Dental Mfg. Co.
Aristaloy	Baker & Co., Inc.
Banner (Filings)	Goldsmith Bros. S. & R. Co.
Blue Diamond (Filings)	Reliance Dental Mfg. Co.
Brewster Medium (Shavings)	E. R. S. Brewster
Brewster Quick (Filings)	E. R. S. Brewster
Brewster Quick (Shavings)	E. R. S. Brewster
Capeako (Filings)	Precious Metals Refining Works
Certified	Lee S. Smith & Sons Mfg. Co.
Coe	Coe Laboratories, Inc.
Dee (Filings)	Thomas J. Dee & Co.
Excel	Daniels Dental Alloy Co.
Fellowship (Filings) (Medium Setting)	The Dental Protective Supply Co.
Keystone	Lee S. Smith & Sons Mfg. Co.
Minimax (Filings) (Shavings) 172 173 173 177 174 178 177 180 178 161 180 181 183 161	The Minimax Co.
Minimax White Gold & Platinum	The Minimax Co.
Mission No. 5	San Diego Smelting & Refining Co.
Mission No. 5 "A" Cut	San Diego Smelting & Refining Co.
Mission No. 6	San Diego Smelting & Refining Co.
Modeloy (Quick Setting) (Filings)	Crescent Dental Mfg. Co.
Ney-Aloy	The J. M. Ney Co.
Odontographic "Improved" (Filings)	Odontographic Mfg. Co.
Preferred D	Precious Metals Refining Works
Preferred C	Precious Metals Refining Works
Royal-Special First Setting	Garhart Dental Specialty Co.
Silverex	Interstate Dental Co., Inc.
Silverloy (Filing & Shavings)	Crescent Dental Mfg. Co.
Speyer	Speyer Smelting & Refining Co.
S-C Medium (Filings)	Stratford-Cookson Co.
S-C Quick (Filings)	Stratford-Cookson Co.
True Dentalloy (Filings)	The S. S. White Dental Mfg. Co.
True Dentalloy (Cut A)	The S. S. White Dental Mfg. Co.
Twentieth Century (Filings)	The L. D. Caulk Co.
White Beauty	Lang Dental Mfg. Co.

ican Dental Association by the various manufacturers were purchased on the open market by the Research Commission and tested by the A.D.A. Research Associates at the National Bureau of Standards. As of July 1, 1935, the list of alloys in Table 2 were found to comply with American Dental Association specifications. Alloys that did not comply are omitted from this list.

by the various manufacturers were purchased on the open market by the Research Commission and tested by the A.D.A. Research Associates at the National Bureau of Standards. As of July 1, 1935, the list of investments in Table 3 were found to comply with American Dental Association specification. Investments that did not comply are omitted from this list.

TABLE 3.—SECOND SURVEY OF INVESTMENTS

(June 24, 1935)

Investment	Manufacturer or Distributor
Coecal Inlay	Coe Laboratories, Inc.
Coecal Universal	Coe Laboratories, Inc.
Kerr Cristobalite-Inlay	Detroit Dental Mfg. Co.
Kerr No. 3	Detroit Dental Mfg. Co.
Ransom and Randolph Gray	The Ransom & Randolph Co.
Ransom and Randolph Green	The Ransom & Randolph Co.
Ransom and Randolph X-45	The Ransom & Randolph Co.
S. S. White Inlay No. 20	The S. S. White Dental Mfg. Co.
Security Improved Inlay	The Cleveland Dental Mfg. Co.

TABLE 4.—IMPRESSION COMPOUNDS COMPLYING WITH SPECIFICATION NO. 3

Compound	Manufacturer or Distributor
Brewster	E. R. S. Brewster
Certified	Lee S. Smith & Son Mfg. Co.
Dresch	The Ransom and Randolph Co.
Kerr Black	Detroit Dental Mfg. Co.
Kerr No. 3	Detroit Dental Mfg. Co.
Kerr Perfection	Detroit Dental Mfg. Co.
Kerr White	Detroit Dental Mfg. Co.
Moyer	The J. Bird Moyer Co.
S. S. White—Black—Tray	The S. S. White Dental Mfg. Co.

CERTIFIED INLAY CASTING INVESTMENTS A.D.A. SPECIFICATIONS NO. 2[2]

Samples of all inlay casting investments certified to the Research Commission of the American Dental Association

2. Taylor, N. O.: Paffenbarger, G. C., and Sweeney, W. T.: Dental Inlay Casting Investments: Physical Properties and Specification, J.A.D.A., 17:2266 (Dec.) 1930.

CERTIFIED IMPRESSION COMPOUNDS A.D.A. SPECIFICATION NO. 3[3]

Samples of all impression compounds certified to the Research Commission of the American Dental Association by the various manufacturers were purchased on

3. Taylor, N. O.; Sweeney, W. T., and Paffenbarger, G. C.: Specification for Dental Impression Compounds, J.A.D.A., 18:53 (Jan.) 1931.

the open market by the Research Commission and tested by the American Dental Association Research Associates at the National Bureau of Standards. As of Aug. 1, 1935, the list of compounds in Table 4 were found to comply with American Dental Association specification No. 3. Compounds that did not comply are omitted from the list.

CERTIFIED INLAY CASTING WAX A.D.A. SPECIFICATION NO. 4[4]

Samples of all inlay casting waxes certified to the Research Commission of the American Dental Association by the various manufacturers were purchased on the open market by the Research Commission and tested by the American Dental Association Research Associates at the National Bureau of Standards. As of Aug. 1, 1935, the list of waxes in Table 5 were found to comply with American Dental Association specification No. 4. Waxes that did not comply are omitted from the list.

TABLE 5.—WAXES COMPLYING WITH SPECIFICATION NO. 4

Wax	Manufacturer or Distributor
Brewster	E. R. S. Brewster
Caulk-Blue	L. D. Caulk Company
Kerr Blue—Hard	Detroit Dental Mfg. Co.
Maves	The Heidbrink Co.
Peck's Blue	A. E. Peck Mfg. Co.
Security	The Cleveland Dental Mfg. Co.

CERTIFIED INLAY CASTING GOLDS A.D.A. SPECIFICATION NO. 5[5]

The inlay casting golds complying with A.D.A. specification No. 5 are listed in Table 6.

CERTIFIED DENTAL MERCURY A.D.A. SPECIFICATION NO. 6[6]

Certified dental mercuries complying with A.D.A. Specification No. 6 are listed in Table 7.

CERTIFIED WROUGHT GOLD WIRE ALLOYS A.D.A. SPECIFICATION NO. 7[7]

Certified wrought gold wire alloys A.D.A. specification No. 7 are listed in Table 8.

CERTIFIED ZINC PHOSPHATE CEMENTS A.D.A. SPECIFICATION NO. 8[8]

Samples of all zinc phosphate cements certified to the Research Commission of the American Dental Association by the various manufacturers were procured on the open market and tested by the American Dental Association Research Associates at the National Bureau of Standards, as of Jan. 1, 1936. The list of cements in Table 9 are those found to comply with American Dental Association specification No. 8. The powders and liquids of the cements were found to conform to the requirements prescribed by the U. S. Pharmacopeia (current edi-

4. Taylor, N. O.; Paffenbarger, G. C., and Sweeney, W. T.: Specification for Inlay Casting Wax, J.A.D.A., 18:40 (Jan.) 1931.

5. Taylor, N. O.; Paffenbarger, G. C., and Sweeney W. T.: Inlay Casting Golds: Physical Properties and Specifications, J.A.D.A., 19:36 (Jan.) 1932.

6. Isaacs, Aaron: Mercury for Dental Amalgams, J.A.D.A., 19:54 (Jan.) 1932.

7. Paffenbarger, G. C.; Sweeney, W. T., and Isaacs, Aaron: Wrought Gold Wire Alloys: Physical Properties and Specification, J.A.D.A., 19:2061 (Dec.) 1932.

8. Paffenbarger, G. C.; Sweeney, W. T., and Isaacs, Aaron: Zinc Phosphate Cements: Physical Properties and Specification, J.A.D.A., 21:1907 (Nov.) 1934.

TABLE 6.—INLAY CASTING GOLDS COMPLYING WITH SPECIFICATION No. 5*

Alloy	Type†	Manufacturer or Distributor
Chilcast No. 1	A	Vernon-Benshoff Co.
Chilcast No. 1-A	B	Vernon-Benshoff Co.
Chilcast No. 2	C	Vernon-Benshoff Co.
Chilcast No. 2-A	B and C	Vernon-Benshoff Co.
Chilcast No. 3	C	Vernon-Benshoff Co.
Coe 1	A and B	Coe Laboratories, Inc.
Coe 2	B and C	Coe Laboratories, Inc.
Coe 3	C	Coe Laboratories, Inc.
Crown No. 1	A	Patterson-Hettinger Co.
Crown No. 2	B	Patterson-Hettinger Co.
Crown No. 3	C	Patterson-Hettinger Co.
Deetwo Light	A	Thomas J. Dee & Co.
Deetwo	B	Thomas J. Dee & Co.
Deesix	B	Thomas J. Dee & Co.
Goldsmith Inlay No. 1	A	Goldsmith Bros. S. & R. Co.
Goldsmith Inlay No. 2-Medium	B	Goldsmith Bros. S. & R. Co.
Goldsmith Inlay No. 3-Hard	C	Goldsmith Bros. S. & R. Co.
Jelenko Alboro Inlay	C	J. F. Jelenko & Co., Inc.
Jelenko Durocast	C	J. F. Jelenko & Co., Inc.
Jelenko Inlay Gold	B	J. F. Jelenko & Co., Inc.
Jelenko Platin-Cast	B	J. F. Jelenko & Co., Inc.
Jelenko Special Inlay	A	J. F. Jelenko & Co., Inc.
K Inlay	A	Patterson-Hettinger Co.
Knapp No. 1	A	Patterson-Hettinger Co.
Knapp No. 2	B	Patterson-Hettinger Co.
Knapp No. 3	C	Patterson-Hettinger Co.
Ney-Oro A	A	The J. M. Ney Co.
Ney-Oro A-1	B	The J. M. Ney Co.
Ney-Oro B	C	The J. M. Ney Co.
Ney-Oro B-2	C	The J. M. Ney Co.
No. 1 Hard Inlay	B and C	Patterson-Hettinger Co.
No. 2 Cast Inlay	A	Patterson-Hettinger Co.
No. 9 Cast Gold	C	Patterson-Hettinger Co.
Spyco Hard	B	Spyco Smelting and Refining Co.
Spyco Soft	A	Spyco Smelting and Refining Co.
Spyco No. 6	C	Spyco Smelting and Refining Co.
S. S. White No. 2	A	The S. S. White Dental Mfg. Co.
S. S. White No. 1	B	The S. S. White Dental Mfg. Co.
S. S. White No. 13	C	The S. S. White Dental Mfg. Co.
S. S. White No. 31 Metalba	B	The S. S. White Dental Mfg. Co.
Stern No. 2847	C	I. Stern and Co.
Stern No. 3290	B	I. Stern and Co.
Stern No. 3337	B and C	I. Stern and Co.
Stern No. 3375	A	I. Stern and Co.
Stern No. 3441	C	I. Stern and Co.
Stern No. 3465	B and C	I. Stern and Co.
T	B	Patterson-Hettinger Co.
TT	C	Patterson-Hettinger Co.
Tinker No. 1	B	Spyco Smelting and Refining Co.
Tinker No. 1H	C	Spyco Smelting and Refining Co.
Tinker No. 2	C	Spyco Smelting and Refining Co.

*A revised list is nearing completion.

†Relative hardness: A, soft; B, medium; C, hard.

tion) regarding arsenic content. Cements that did not comply are omitted from this list.

RELATIONS WITH MANUFACTURERS

The Research Commission is pleased with the assistance it has received from the manufacturer. The foregoing list shows that most of the larger manufacturers have certified their products to the commission. The secretary has been informed by certain manufacturers that it is becoming increasingly difficult to market products that have not been certified to the commission. This is especially true of amalgam alloys. In certain instances, of course, the manufacturer might not go to the trouble and expense of routinely testing their products and of assisting the commission in its program were it not for the fact that dentists are demanding products that will measure up to the American Dental Association standards. In reality, the success of the program is in the hands of the dentist.

In all instances wherein a material certified to the commission did not comply with the specification, the manufacturer was notified that either the product must be changed so that it would comply, or that the statement guaranteeing compliance with the specification be deleted. All such instances were adjusted amicably, it being unnecessary to present any cases to the Federal Trade Commission for adjustment during the fiscal year. No fees for attorneys or for legal advice have ever been paid by the commission in the adjustment of differences with manufacturers.

As an illustration of the effect of these research investigations on the manufacturer and the development of dental materials, the commission desires to make a statement regarding the situation relative to the manufacture of the zinc phosphate cements. After the publication of the two research reports in the November, 1933 and 1934 issues of THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION, two manufacturers developed new cements of this type, while four concerns modified their products so that they would comply with the high standard of the American Dental Association. Some of the tests described in the foregoing

TABLE 7.—MERCURIES COMPLYING WITH SPECIFICATION NO. 6

Mercury	Manufacturer or Distributor
Argentum	Hammond Dental Mfg. Co.
Chemically Pure	S. S. White Dental Mfg. Co.
Dee	Thomas J. Dee & Co.
Dental	Goldsmith Bros. S. & R. Co.
Mercury Laboratories	Mercury Laboratories, Inc.
Minimax	The Minimax Co.
Mission	San Diego Smelting & Refining Co.
Mynol	Mynol Chemical Co.
Ney's C. P.*	The J. M. Ney Co.
Odontographic	Odontographic Mfg. Co.
Positively Pure	Garhart Dental Specialty Co.
R. P. C	Research Products Corporation
Twentieth Century	The L. D. Caulk Co.

*This certificate does not apply to Ney's C. P. mercury in one pound jugs, since the jugs are not glass.

cement reports are now being used in the dental trade as factory production control tests, this assuring uniformity in the manufacture of this dental commodity. Some of the manufacturing concerns that did not have equipment or personnel to do such testing have now procured them. Similar instances could be cited in the fields of the other materials such as amalgam, investments, inlay waxes, inlay golds, wrought gold wires, impression compounds and dental mercury, which have been investigated and for which specifications have been formulated.

LIST OF PUBLICATIONS (1935-1936)

The following reports were published in THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION:

1. A study of Zinc Phosphate Cement by a Group of Practicing Dentists under the Direction of the American Dental Association, Research Fellowship at the National Bureau of Standards, 22:1281 (Aug.) 1935.

2. Revised List of Certified Inlay Casting Investments, 22:1384 (Aug.) 1935.

3. Revised List of Certified Impression Compounds, 22:1742 (Oct.) 1935.

TABLE 8.—WROUGHT GOLD WIRE ALLOYS COMPLYING WITH SPECIFICATION NO. 7

Alloy	Manufacturer or Distributor
Deepep-Hard	Thomas J. Dee & Co.
High Fusing Clasp	Goldsmith Bros. S. & R. Co.
Jelenko No. 3 Wire	J. F. Jelenko & Co., Inc.
Jelenko Super Wire	J. F. Jelenko & Co., Inc.
Medium Clasp	Goldsmith Bros. S. & R. Co.
Ney-Oro Elastic No. 2	The J. M. Ney Co.
Ney-Oro Elastic No. 4	The J. M. Ney Co.
Neydium 9	The J. M. Ney Co.
Regular Clasp	Goldsmith Bros. S. & R. Co.
Spyco No. 3	Spyco Smelting and Refining Co.
Spyco No. 4	Spyco Smelting and Refining Co.
Stern No. 2657	I. Stern and Co., Inc.

The organized dental profession in America is thus setting a high standard for the materials that they are using and are demanding that materials be procured that will meet these standards. This is as it should be. The dentist is now in a position to tell the manufacturer the quality of materials that he wants to use instead of accepting what the manufacturer offers.

The Research Commission considers that the influence of this work in this respect is in itself sufficient to justify all of the appropriations that the commission has ever allocated to this work.

4. Revised List of Certified Zinc Phosphate Cements, 23:299 (Feb.) 1936.

Two additional papers were prepared:

1. A Progress Report on Denture Base Materials (1935) (Sent to the Editor of THE JOURNAL, April, 1936).[9]

2. The Physical and Chemical Properties of the Dental Silicate Cements (completed and ready for publication).

The commission is greatly indebted to the Editor of THE JOURNAL for his prompt publication of its reports and for his cooperation on all matters.

9. Published August, 1936.

REVISION OF SPECIFICATIONS

The American Dental Association specifications for amalgam, inlay casting investment, inlay wax, impression compound, inlay casting gold, wrought gold wire, dental mercury and dental cementing medium are being revised. Many helpful suggestions were received from manufacturers and dental schools. Those specifications whose revisions are completed in time will be presented to the House of Delegates for consideration at this meeting.

INFLUENCE OF WORK IN EDUCATIONAL CIRCLES

The investigative work on dental materials has had a pronounced effect on dental pedagogy. As an illustration of the high esteem in which the work is held by dental teachers, the following quotation from "A Course of Study in Dentistry—Report of the Curriculum Survey Committee, American Association of Dental Schools, 1935," page 50, is given:

A promising development that is resulting in the improvement of restorative dentistry consists of the research that is being conducted on the materials used and their manipulation. With all due respect to the earlier investigators in this field—and a number of them made outstanding contributions—it must be admitted that the current investigations of the American Dental Association Research Group working with the staff of the National Bureau of Standards has awakened a new interest of the dentist in materials. This group has set up specifications for these materials, which are primarily intended to set desirable standards and protect the dentist from false and unscrupulous claims from which the profession has suffered much in the past, and it has disseminated much information as to reliable products and methods of manipulation of materials. The work has resulted in considerable valuable research on the part of manufacturers of dental materials, which has both improved their products and inspired the invention of new ones.

The Curriculum Survey Committee has also outlined a course of study, "Materials Used in Dentistry and Their Manipulation," which is being used as a guide for teaching courses of this character.

Most of the dental textbooks in which dental materials are discussed have utilized our reports to a great extent.

A personal report of our senior Research Associate at the National Bureau of Standards follows:

OUTLINE OF THE COOPERATIVE DENTAL RESEARCH BETWEEN THE NATIONAL BUREAU OF STANDARDS AND THE AMERICAN DENTAL ASSOCIATION (1935-1936)

The cooperative research work of the National Bureau of Standards and the

TABLE 9.—ZINC PHOSPHATE CEMENTS COMPLYING WITH SPECIFICATION NO. 8

Cement	Manufacturer or Distributor
Ames Z-M	The W. V. B. Ames Co.
Caulk, Crown & Bridge	The L. D. Caulk Co.
Caulk, Petroid Improved	The L. D. Caulk Co.
Caulk, Tenacin	The L. D. Caulk Co.
Fleck	The J. R. Stanley Chemical Co.
Lang	Lang Dental Mfg. Co.
Smith	Lee S. Smith & Son Mfg. Co.
S. S. White, Zinc	The S. S. White Dental Mfg. Co.

American Dental Association on dental materials for the fiscal year 1935-1936 includes: (1) testing of silicate cements, (2) testing of denture base materials (vulcanite and synthetic resins), (3) testing of certified materials, (4) revision of specifications and (5) miscellaneous activities.

Silicate Cements.—The silicate cement investigation is practically completed and sufficient data are available for the formulation of a satisfactory specification for these cements.

The study included the following:

(*a*) Chemical analysis of the powders and liquids: The powders were found to be complex aluminosilicates containing calcium, sodium, magnesium, fluorine and phosphorus. They could be roughly classified into two types, based upon whether they contained fluorine. There is some relationship, between physical properties and the composition. Arsenic was not present in more than one part in 100,000.

(*b*) Consistency of mix: After a method that would quantitatively measure the consistency was evolved, a standard testing consistency was selected. The selection of this standard consistency was based upon data from dentists and manufacturers. There was a considerable variation among the cements in the amount of powder that could be incorporated in a definite quantity of liquid to produce the same consistency of mix. By means of the consistency test, differences among batches of cement were demonstrated.

(*c*) Time of setting: A standard Gillmore needle was used to determine the time of setting at room and body temperatures. The effect of the powder:liquid ratio, of temperature and humidity conditions and of the loss or gain of water from the cement liquids was determined.

(*d*) Compressive strength: The influence of such factors as time, powder:liquid ratio, immersion mediums and method of preparing test specimens was determined.

(*e*) Dimensional change on setting: All of the cements shrank on setting. On some cements, there is a surface expansion in the presence of water. The size and shape of the specimen, therefore, affect the dimensional change. The so-called "mercurochrome test" does not give a true indication of shrinkage or expansion. As the interferometer as set up for testing amalgam is not a suitable instrument for this type of work, another instrument was designed.

(*f*) p_H measurements: All of the cement powders were slightly alkaline (p_H 7.5 to 7.6) with one exception (p_H 5.3). All of the liquids were decidedly acid (p_H 1.9 to 2.3). The most acid of the liquids was advertised as being practically neutral. All of the set cements were acid. The degree of acidity depended on such factors as composition, powder:liquid ratio and age of the specimens. Some of the cements approached neutrality at the end of twenty-four hours.

(*g*) Solubility: Solubility of the cements when immersed in distilled water at body temperature for one week ranged from over 5 per cent to less than 0.7 per cent by weight. After the first week, the rate of solubility markedly decreased. Among the elements influencing solubility were composition, powder:liquid ratio, surface condition of specimen, age of specimen and time of immersion. The solubility of the hardened cement, the cement powder and human enamel and dentin was compared.

(*h*) Tests with dyes: The testing of cements with dyes was found to be unreliable, the results depending on the character of the dye material. Basic dyes stained more than the acid ones. The p_H of the cements also affected the staining, insoluble lakes being formed in some instances.

(*i*) Changes in cement liquids with humidity variations: All of the liquids lost or gained water, this depending on the relative humidity of the atmosphere in which they were exposed. This unbalancing of the liquids seriously affected the physical properties of the cements.

(*j*) Translucency: By means of a reflectometer, the translucency of all of the cements and of human dentin and enamel was measured. In some instances, the translucency of the cement approached that of the tooth structures. Index of refraction measurements were also made on the cements and human enamel and dentin.

(*k*) Use of oily substances: The use of

petrolatum and oils in the cements produced both favorable and unfavorable actions. Shrinkage and solubility were slightly reduced, but the tendency to stain was increased. The compressive strength was markedly reduced.

(A report of the silicate cement work was prepared by George C. Paffenbarger and Irl C. Schoonover.)

Denture Base Materials.—The main object of this work is to define a satisfactory material by means of physical tests that can be embodied in a specification. Progress has been slow because of the complex nature of the problem, but certain definite facts of great importance have been unearthed in the study. A discussion of these follows:

(*a*) Tensile strength: The tensile strength of all of the materials studied (olive base, vulcanite, phenol-formaldehyde, vinyl and cellulose compounds) seems adequate. Vulcanite and vinyl resins were slightly higher in tensile strength, when tested under similar conditions, than was the phenol-formaldehyde resin, while the cellulose compounds were lower.

(*b*) Elongation or set: The amount of stretching or elongation of all four classes seems adequate when their clinical success is taken into account. Cellulose compounds had the most; phenol-formaldehyde resin the least. Vulcanite and vinyl were in between and were about equal.

(*c*) Impact strength: Tests of this type give some indication of the ability of the material to withstand shocks such as the dropping of a denture. Vinyl resin and cellulose compound were superior, with vulcanite following, and phenol-formaldehyde a poor fourth. Here, again, failure in service cannot be connected with a physical test.

(*d*) Flexural fatigue: Phenol-formaldehyde resin and vulcanite have higher flexural fatigue strength then does the vinyl type. A considerable improvement in flexural fatigue strength has been noted in the vinyl resin, which may help to explain their improvement in service as compared to their earlier record.

(*e*) Water absorption: The cellulose compounds were decidedly inferior and tended to warp badly when alternately soaked and dried. The water in which they were immersed also smelled strongly of camphor, confirming clinical observations of a "camphor taste." The values of the other three types of materials were not importantly different.

(*f*) Softening point: The softening points were determined by means of a transverse bend test. Vulcanite, phenol-formaldehyde, vinyl and cellulose compounds ranged from the highest to the lowest, respectfully. The softening point of the cellulose compounds appears to approach the temperatures to which they would be subjected in the mouth.

(*g*) Warping: When all of the materials were heated in a steam bath and in water at its boiling point, the cellulose compounds and vinyl resin showed pronounced changes in form, while vulcanite and phenol-formaldehyde remained unchanged. It is believed that this warping is caused by internal strain imparted to the materials during deformation in pressing. Measuring of the amount of strain occurring at different processing temperatures is now in progress. The temperatures at which these strains are relieved are being studied by means of thermal expansion curves and polarized light. It may be possible to find a suitable annealing temperature, whereby the internal strain developed in the denture during pressing could be relieved.

(*h*) Color life: Samples of the materials were exposed to the rays of a carbon arc lamp whose spectral distribution is similar to sun light. The color of vulcanite was changed the least, of vinyl resin the most, with that of phenol-formaldehyde between.

(*i*) Heat transfer: There was no practical difference in the materials. Unfortunately, all are very poor heat conductors. It was interesting to note that the metal filled rubbers were not, as has often been claimed, superior in this respect.

It is apparent that the thermoset type of resins, such as vulcanite and the phenol-formaldehyde group, have some distinct advantages over those of the thermoplastic type, such as the vinyl resins and the cellulose compounds.

The work this year was conducted by W. T. Sweeney and Irl C. Schoonover.

Testing of Certified Material.—During the past year, the testing of products on the certified list and of those products offered for certification has been a major item in the work of the fellowship. A summary of the testing ensues:

(*a*) Six amalgam alloys guaranteed to comply with American Dental Association specification No. 1 were tested. Fifty per cent of these were found to meet the specification requirements.

(*b*) Nine certified inlay casting investments were tested for compliance with American Dental Association specification No. 2. Eighty-nine per cent complied.

(*c*) Seven certified impression compounds were tested for compliance with American Dental Association specification No. 3. All complied.

(*d*) Seven certified inlay casting waxes were tested for compliance with American Dental Association specification No. 4. Seventy-one per cent complied.

(*e*) Nine zinc phosphate cements, which were certified to the Research Commission as complying with American Dental Association specification No. 8, were tested. Seventy-eight per cent complied. All of the cements were tested for arsenic and were found to be within the limits specified in the U. S. Pharmacopeia XI.

(*f*) One mercury was rejected for certification because it did not comply with American Dental Association specification No. 6. This mercury was recertified some months later and was found to comply.

(*g*) Fifty-five certified inlay casting golds are being tested. The testing of these golds is a long process and includes a determination of their noble metal content. Practically a year will be required to complete all of the tests.

The testing of the certified materials has been conducted largely by John R. Beall. In case a product failed to comply with a specification, two or more additional observers conducted confirmatory tests before the product was recommended for rejection.

Revision of Specifications.—Last year all of the current American Dental Association specifications were forwarded to dental schools and manufacturers for suggestions relative to revision. A summary of all comments received was prepared and mailed to all interested parties for additional remarks. The response to this résumé was gratifying, thirty-four replies being received. With the assistance of these suggestions, tentative revisions of American Dental Association specifications Nos. 1, 2, 3, 4, 6, 7, and 8 were prepared and forwarded to the manufacturers and dental schools for further discussion. The contemplated revision of American Dental Association specification No. 5 for inlay casting golds is more fundamental than the other revisions and will necessitate considerable experimental procedure.

Miscellaneous Activities.—Approximate-

TABLE 10.—COMPARATIVE FINANCIAL STATEMENT

	Grant for 1935-1936	Disbursed June 30, 1936	Unexpended Balance
1. American Dental Association Research Fellowship at the National Bureau of Standards	$10,500.00	$10,500.00	
2. University of Louisville	750.00	750.00	
3. New York Institute of Clinical Oral Pathology, Inc.	750.00	750.00	
4 Research on Local Anesthesia, College of Physicians and Surgeons	250.00	250.00	
5. Executive Board	500.00	500.00	
6. Secretary's Office	250.00	249.94	00.06
	$13,000.00	$12,999.94	$00.06

ly ninety persons visited the laboratory during the past year. Included among these were visitors from Sweden, Poland, Japan and Australia.

Reports of the work were presented before the following societies: Columbus Dental Society (Ohio), Midwinter Clinic of the Chicago Dental Society, Five States Meeting, Annual Meeting of the American Dental Association in New Orleans, International Association for Dental Research, Maryland State Society and American Association of Dental Schools. It is estimated that about 900 dentists were present when the reports were given.

A paper on zinc phosphate cements has been prepared for publication in the proceedings of the Ninth International Dental Congress.

An exhibit of the work on silicate cement and denture base materials has been prepared.

GEORGE C. PAFFENBARGER,
Research Associate.

GRANT NO. 2: UNIVERSITY OF LOUISVILLE

This project at the University of Louisville has been financially assisted by the Research Commission for several years. The allocation of $750 was used entirely for the purpose of assisting Theodore B. Beust in his research laboratory. An exhibit of the important and practical work being carried on under this project was shown at the American Association for the Advancement of Science at St. Louis, Mo., in January, 1936.

A report of the studies carried on by Dr. Beust (John T. O'Rourke, adviser) published in the Proceedings of the Board of Trustees and Reports of Officers and Committees of the American Dental Association, July 13-17, 1936, San Francisco, Calif.; also in the Transactions of the 78th Annual Sessions of the American Dental Association, San Francisco, Calif., July 13-17, 1936.

GRANT NO. 3: THE NEW YORK INSTITUTE OF CLINICAL ORAL PATHOLOGY, INC.

The project at the New York Institute of Clinical Oral Pathology, Inc., has been financially assisted by the Research Commission for the past three years. A grant of $750 was allocated by the Research Commission for the last fiscal year.

A report by Theodor Blum was published in the Proceedings of the Board of Trustees and Reports of Officers and Committees of the American Dental Association, July 13-17, 1936, San Francisco, Calif., also in the Transactions of the 78th Annual Session of the American Dental Association, San Francisco, Calif., July 13-17, 1936.

GRANT NO. 4: RESEARCH ON LOCAL ANESTHESIA, COLLEGE OF PHYSICIANS AND SURGEONS

The Research Commission allocated $250 for the partial support of the research on local anesthesia at the College of Physicians and Surgeons during the last fiscal year. It deals with the clinical findings from the use of procaine hydrochloride (novocain) and procaine borate (borocain). A report of this study will be presented in the Section on Oral Surgery, Exodontia and Anesthesia of the American Dental Association at this meeting.

A report submitted by M. L. Tainter (A. R. McDowell, adviser) was published in the Proceedings of the Board of Trustees and Reports of Officers and Committees of the American Dental Association, July 13-17, 1936, San Francisco, Calif.; also in the Transactions of the 78th Annual Session of the American Dental Association, San Francisco, Calif., July 13-17, 1936.

Table 10 shows the expenditures during the fiscal year 1935 and 1936.

P. C. LOWERY, *Chairman.*

ADDRESS OF THE PRESIDENT OF THE AMERICAN ASSOCIATION OF DENTAL EDITORS, 1935-1936

By WILLIAM J. GIES, Ph.D., Sc.D., LL.D., F.A.C.D., New York City

OUR sixth annual meeting, of which this dinner session is a part, is a great success. The proceedings are not only emphasizing the dignity and importance of the purposes of the American Association of Dental Editors, but also strengthening our resolve to endeavor faithfully to attain all of the association's objectives.

During the past official year, though of only eight months, the association has grown steadily in size, strength, influence and usefulness. Including the elections to membership today, the association now has 147 members (editors) representing seventy-three nonproprietary dental journals. Our primary purpose, the advancement of truly professional journalism in dentistry, has been furthered not only by our association and by its individual members, but also by the direct action of other dental organizations, and by the outspoken interest and concern of an increasing number of individual dentists. The report of the Committee on Current Dental Literature, as presented this morning, referred to some of these evidences of growing support for nonproprietary journalism. The American College of Dentists' Commission on Journalism has been widely distributing reprints of the increasing number of searching discussions of proprietary dental journalism. *The Journal of the American College of Dentists* has beeen recurrently publishing summaries of decisions and resolutions, on proprietary journalism, by important dental groups. The owners of one of the oldest proprietary dental journals (S. S. White Dental Manufacturing Company) have recently offered it *(The Dental Cosmos)* as a gift to a leading organization representing the dental profession (The American Dental Association).[1] The American Association of Dental Schools, in its announcement of the pending publication of the *Journal of Dental Education,* stated very emphatically that this new journal will not be a commercial venture. The Omicron Kappa Upsilon honorary society has authorized the publication of a bulletin, which will not be proprietary. Our cause is steadily marching on.

At our annual meeting in New Orleans, last November, the following resolution was adopted:

Resolved, that the American Association of Dental Editors has learned with surprise and regret that some of the Fellows of the American College of Dentists, which brought about the establishment of this association, are members of the editorial staff of the newly established *Nutrition and Dental Health* (a proprietary) journal; and that the secretary be instructed to transmit to the American College of Dentists a copy of this resolution.

A copy was promptly presented to the American College of Dentists, then about to hold its annual convocation. The college responded by adopting the following minute, which was included in a formal circular announcement to all of the members and has been published in the

1. Acceptance voted July 16.

Journal of the American College of Dentists:

The Secretary is hereby instructed to inform our entire membership that the College notes with disfavor and regret that some of its members hold positions on the editorial staffs of proprietary dental journals.

This response to our criticism was a notable recognition of the constructive usefulness of the American Association of Dental Editors.

Five years ago, when this association was organized, we did not overlook the possibility that its establishment might incite the proprietary dental journals to use new and aggressive means to protect their collective financial interests. Fortunately for dentistry, the anticipated activity, although well coordinated at first, has been neither important nor influential. It has become mainly a private effort, by individual proprietors, to hold what can be retained with financial profit against the growing desire within the dental profession that the journalism in dentistry's name shall represent dentistry's character and objectives; shall advance dentistry deservedly in public respect and appreciation, and shall be conducted under professional auspices. Meanwhile, i.e., during the past five years, it has become evident, especially to most of the proprietors, that the privately owned dental journal, like the proprietary dental school, has outlived its usefulness; and the number of proprietary journals has been decreasing, while the number of nonproprietary journals has been increasing. Under these favorable conditions, the association's chief anxieties are therefore problems not of defensive warfare, but rather of constructive ways and means directly to attain the association's objectives.

In harmony with these realizations, and in order to facilitate the forward movement, your present administration early sought to bring about two important structural readjustments:

1. Our charter gave the five founders, as a self-perpetuating board of directors, ample defensive power to guard against disruptive influences. During the past year, the board of directors created by the charter, and the appointive executive committee specified in the bylaws, were made identical in personnel, for the current year, by voluntary act of the board of directors. Our new bylaws, as adopted today, make this desirable readjustment permanent by eliminating the executive committee, and providing that annually the four elective officers and the immediate past president shall be the board of directors to conduct the association's ad interim business.

2. When the association was founded, membership was temporarily restricted to a comparatively small number of the most active proponents of nonproprietary journalism. This was an essential condition at the beginning. Early special defensive measures having, in less than five years, become unnecessary precautions, active membership has been changed to include both "publication" membership and "personal" membership. The new conditions promise to extend the membership to wider ranges of publication influence, and of personal interest and support, at less relative expense for the members, and without decrease in total income from dues.

These two important democratic reconstructions in our organization will give greater impetus and broader effect to all our endeavors.

In 1932, this association, on the recommendation of its committee on advertising, unanimously registered disapproval of the placement of advertisements "on or among the pages devoted to professional affairs." This action was confirmed

in 1933, to be effective in 1934. The association has no power to compel respect for its judgment. I avoid direct allusions to instances of disregard for the association's expressed preference. I hope it will be possible for my successor to say, next year, that all of the publication members have shown the quality, in this regard, that may be expected of editors and managers of truly professional journals.

Reprinting of whole articles or quotations by one journal from others is often very desirable; but there has been a surprising lack of ordinary civility in the matter of crediting to another journal the prior publication of articles or quotations when thus reprinted. Proper accreditation of original prior publication is a journalistic obligation. Disregard for it has presumably been due to inadvertence. Ordinary care would assure the public courtesies that may be reasonably expected among members of this association.

An important deficiency in our procedure needs immediate and lasting correction. I refer to the failure to give adequate publicity to the association's proceedings. Few dentists know about or understand the aims of this association. The proceedings of our first two meetings were published generously by the *Journal of Dental Research;* and portions of the third and fourth were published by the *Journal of the American College of Dentists* and THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION, respectively, without expense to the association. Few of our publication members have given the association's transactions any attention. Our original bylaws, and those now in force, contain the following provisions:

Art. V: Publication of Proceedings. Sec. 3. A publication fund shall be established, which shall be supported by an appropriation of 50 per cent of the annual dues of each member of the association, and by special appropriations and gifts. *Sec. 4.* Expenditures may be made from the publication fund, by a vote of the board of directors, to meet the cost of publishing the proceedings of the association, or for any other purpose that would promote non-proprietary journalism in dentistry.

This fund now consists of an accumulation of the following annual allotments:

1931-1932	$ 90.00
1932-1933	65.50
1933-1934	125.00
1934-1935	147.00
1935-1936 (approximately)	147.50
Total (approximately)	$575.00

At our meeting in 1934, the Committee on Dental Literature alluded to the need for adequate publication of our proceedings. The association, responding to the committee's recommendations, adopted the following resolution:

Resolved, that *The Journal of the American Dental Association* be requested to publish the proceedings of this meeting in an early issue before March, 1935, and that this association offer to pay the expense of adding the required number of pages for this purpose. If, however, this request and offer should be rejected, the editor of this association shall have authority on the same terms to publish the proceedings elsewhere. In either event, the editor shall have authority to obtain and distribute reprints.

Further indifference to the association's needs in this relation would, I feel, be indefensible. Accordingly, in harmony with these conditions, I offer the following four recommendations, which I hope will be not only adopted but also enacted:

1. Hereafter, segregate the publication fund in the treasurer's annual reports, and specify all additions and subtractions.

2. Publish our annual proceedings in full, abstracted in part if desirable, in a

dental journal that will include them at the actual cost of publication or less.

3. Widely distribute, under a special cover, reprints of the proceedings thus published.

4. Abstract our annual proceedings in a form analogous to the proceedings of the International Association for Dental Research as published in the *Journal of Dental Research,* or the dental programs of the American Association for the Advancement of Science as published in the *Journal of the American College of Dentists* and distribute manuscript copies of the proceedings, thus abstracted, to our publication members, for early editorial comment or such other use as may be preferred.

At our annual meeting in 1934, the resolutions there adopted, as affecting policy, included the following:

Resolved, that a special committee be appointed to recommend a procedure to express annually this association's appreciation of the nonproprietary periodical that merits special approval.

The preceding administration did not appoint such a committee. A considerable number of our members believe that this resolution, if enacted, would lead us into mistaken discriminations and into ensuing discord, which should be avoided. For this reason, following the example of my predecessor, I have not appointed such a committee. I recommend that the said resolution be recalled and tabled.

There is urgent need for a disinterested and authoritative public classification of dental journals, on a basis of real and significant distinctions, expressed in direct and simple terms of professional desirability and journalistic quality, and recurrently brought up to date. This association cannot successfully draw important distinctions among its members, and should not attempt the proposed classification. I hope that the American College of Dentists' Commission on Journalism, which has been giving this matter special attention for several years, will soon announce a classification that will serve important constructive purposes. The timeliness of the proposed classification is suggested by the current trend in dental journalism, which, as far as numbers of general types are concerned, is shown by the statistical data in the accompanying tabulation.

The indicated numbers of proprietary journals in the foregoing summary, received from the American College of Dentists' Commission on Journalism, includes some conspicuous "house organs" which do not pretend to be more than "sales circulars."

General Types	1928 (January 1)	1932 (January 1)	1935 (November 1)
Nonproprietary	61	89	105
Proprietary	22	26	18
Unclassified	0	2	1
Total	83	117	124

Uniformity in the journalistic use of abbreviations for the names of periodicals, and for related bibliographic data, is very desirable. Uniformity would promote accuracy, assure definiteness and serve convenience. Agreement as to the most acceptable uniformity should be achieved and observed. Librarians particularly are interested in this matter, because uniformity is essential in a card index, to say nothing of other desirabilities. I recommend that the board of directors give this matter special attention.

This association is dedicated to the advancement of truly professional dental journalism. Since journalism in the name of a profession, but under proprietary

control, is neither responsible to that profession, nor responsive to the profession's standards or public requirements, the association is opposed to proprietary dental journalism as a system. Our objections stand squarely on the following four basic considerations:

1. Journals, as a group, disseminate information, develop opinion and influence conduct. They are useful, useless, or harmful as they perform these functions well, poorly or unworthily.

2. Journals in a profession cannot perform these important public functions, responsibly and reliably, unless they fully and faithfully represent the character, honor and objectives of that profession.

3. Journals in a profession, when owned and controlled by or for the profession, are conducted by managements animated by loyalty to the objectives of the profession; by fidelity to the profession's integrity, and by devotion to the profession's aspirations. Financial profit is not a primary motive. Any such profit as may accrue is used to support either the respective journals or other professional projects.

4. Journals issued in the name of a profession, when proprietary, are conducted by managements that have no professional incentives, and which commonly not only degrade the integrity and welfare of the profession to commercial purposes, but also exploit the profession for private profit. The editors of such journals, when members of a profession, are not employed by owners to subordinate private profit to professional ideals. The aims of proprietary management, which are primarily private and commercial, accord with professional objectives only, as a rule, when such harmony promises to increase profit or to prevent loss for the owners and their agents.

Exceptions to any of these four "basic considerations" prove the rule to which the variations apply. Occasionally fortunate influences of a few persons or periodicals, in proprietary dental journalism, neither support nor justify proprietary control as a system. The proprietary conditions that have ceased to be respectable in the field of dental education are no longer commendable in dental journalism.

The four "basic considerations" to which I have just alluded may seem to be too general and elementary to indicate the full scope of our convictions. When they are subjected to analysis, the following constituent facts and related conditions become evident:

A. Dentistry could not attain its greatest usefulness half trade and half profession. It must become one or the other. It is becoming whole profession, not whole trade.

B. Dentists, in increasing numbers, are opposing and correcting the surviving trade influences in dentistry. Proprietary journalism is one of these influences.

C. Journalism in a profession is an essential means of professional education. Therefore, it should be conducted wholly under professional auspices.

D. Dentistry, in its progress as a profession, recently, for good and sufficient reasons, eliminated the proprietary dental school. The proprietary dental journal should be discontinued for the same general reasons. This discontinuance will occur as soon as most dentists realize the need for it and demand it.

E. Proprietary dental journalism should be discontinued because it is attended by conditions and influences that are harmful to dentistry. Among the many such conditions and influences are these:

(*a*) Commercial owners conduct their journals primarily for financial profit and only secondarily, if at all, for the advancement of the dental profession.

(*b*) Editors and managers are responsible to, and their terms of employment are dependent on, the commercial owners who pay the salaries. The private requirements and commercial interests of the owners cannot be successfully disregarded.

(*c*) Editors and managers are obliged to bring the contents of the successive issues into conformity with the private commercial aims and expectations of the proprietors. The editors are not free to make up the successive issues without adjusting selections as well as rejections of material to the private commercial requirements on which the editorial salaries are based. These commercial requirements lose none of their effectiveness as to detail, if stated to editors and managers in general terms.

(*d*) Acceptance of advertisements must accord with the commercial purpose to publish those that collectively yield, directly or indirectly, the largest income or the greatest private advantage. Usually, the advertisements that are accepted by proprietary journals include the least worthy types of commodities, devices or services, and their publication not only violates the profession's honor and integrity, but also is harmful to the public.

(*e*) Since editors and managers are not free to exercise judgment or "independence" beyond the scope of commercial restrictions, nor to place public and professional obligations above private commercial preferences, "freedom of the press" among proprietary dental journals is, in reality, "freedom of the proprietors to exploit the dental profession." Editorial "independence" in a proprietary dental journal does not attain either intellectual freedom or personal independence; instead, it is commercial independence of the profession.

(*f*) The financial support that proprietary journals receive from ethical dentists, and from reputable advertisers, tends, in a kind of competition that is against public and professional interests, to reduce the resources available to the worthiest nonproprietary journals.

(*g*) Public appreciation of, and respect for, dentistry as a profession is impaired by lay observations of proprietary control of dental journals, especially as illustrated by the "throw aways."

If, after the foregoing analysis, we subject the resultant "facts and conditions" to a synthesis, the following conclusions among many from a different point of view, regarding professional journalism in general, appear in that reconstruction:

1. Dentistry, as a natural division of health service, is one of the most useful means for the promotion of comfort, welfare and happiness.

2. Dentistry, which on an accredited system of professional education promotes the public welfare by applying the blessings of oral health service, is becoming one of the noblest professions.

3. Some influential dentists individually continue to condone commercial conditions and objectives in dentistry, and, by their conduct, suggest erroneously to many laymen that dentistry is mainly a trade, a craft or a business. Fortunately, the number of dentists who are indifferent to professional ideals and to professional obligations is diminishing, and the influence of their unworthy example is decreasing.

4. The aims of commercialism and the purposes of a profession usually conflict. A profession, while seeking a comfortable livelihood on reasonable and fair terms for its members, bases its ethics on the greatest degree of generous personal service by its practitioners in accord with the highest ideals of honor, fidelity and efficiency.

5. A profession that is true to its ideals

and to its public protestations will not permit the voice of commerce to speak its views, nor the objectives of commerce to guide its behavior.

6. All true professions aim continually to strengthen the ideals and promote the efficiency of their members, through various agencies, among the most important of which are periodical publications.

7. Journals in a profession portray its character and indicate its quality. Journals published in the name of a profession do not survive unless they receive support or approval from a large proportion of the members of that profession.

8. Commercial control of journals that purport to represent professional thought and action, when that control is approved or tolerated by a profession, implies deficiency in professional character, in professional responsibility and in professional self-respect.

9. Free proprietary journals, which are always conducted primarily as floats for advertisements, do not gain the respect, or receive the support, of truly professional men, for such men know that behind the free distribution lurk private commercial objectives that always degrade, and often dishonor, the profession.

10. The disabilities of a nonproprietary journal—they may be numerous and glaring—are curable not by injections of private commercialism, but by adequate nourishment to sustain professional vitality and to promote public function.

Ways and means to support and strengthen dental journalism, and to give it the highest professional usefulness, will engage the active attention of this association for many years to come. In considering the scope of this address, I was tempted to restrict it to such ways and means, and especially to discuss the intellectual and spiritual requirements of editorial leadership. I decided to leave to my successors thorough discussion of this broad problem. I shall refer briefly and directly, although generally, to only a single aspect, the one that seems to be the most urgent immediate requirement for all nonproprietary dental journals without exception.

The present outstanding physical need in dental journalism is adequate financial support for the full normal development of the most useful nonproprietary periodicals. It has long been obvious that whereas proprietary journals have, as a rule, been organized and conducted to pay attractive salaries to their editors and to yield large profits to their owners, nonproprietary journals are usually conducted at a financial loss. This striking difference is largely due to unprincipled publication, by proprietary journals, of misleading or untruthful advertisements, the kind for which the highest rates can be obtained, but the fact remains that dentists as a group, accustomed by the proprietary journals to expect something for nothing, and failing to realize the need for effective development of truly professional journalism, are not yet inclined to make the financial expenditures that are required to provide it. Successful plans to promote distribution of acceptable advertisements, among allied nonproprietary journals, such as that proposed by our committee on advertising, would be very beneficial, not only to journals needing greater financial support, but also to reputable advertisers desiring assurance of responsive cooperation from ethical dentists. Special means should be used by this association to induce the dental profession to meet these important professional obligations.

The current tendency to multiply nonproprietary journals to represent restricted purposes, small groups or narrow interests, while very desirable in principle, may weaken dental journalism by dissipating subscription and advertise-

ment resources that might be effectively concentrated on a smaller number of the most useful periodicals. Some unions or mergers would clearly be advantageous. All honorable efforts to transfer ownership of historically important proprietary journals to organizations representative of the dental profession, and to unite them with other journals under the historic names, should be welcomed and encouraged. Such conversions, or mergers with nonproprietary journals, would be as beneficial to dental journalism as the similar conversions of proprietary dental schools into integral parts of universities have been to dental education. (The union of *The Dental Cosmos* with THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION will be historically as significant as the union of the Baltimore College of Dental Surgery with the Dental School of the University of Maryland.)

It is a pleasure to report that, during the year, our officers have sedulously endeavored to meet all of their official obligations. All committees have labored faithfully, under the guidance of earnest chairmen, to perform their constructive duties. Deserving of direct special praise are the secretary, Dr. Brandhorst, for his very efficient executive work throughout the year, and the expresident, Dr. Gurley, as chairman of the special committee on program, for his success in evolving the excellent program of this meeting. It has been a privilege, an honor and a pleasure to serve with associates as capable, faithful and enthusiastic as those constituting the official personnel of the administration about to close.

Twenty years ago, in an address in Boston, at the beginning of my special endeavors to promote the advancement of nonproprietary journalism in dentistry, I referred to the then prevailing tradehouse journalism, in part as follows:

> Trade journalism in a profession is a form of vulgar autocracy. When it is benevolent, it pauperizes; when it is benignant, it patronizes; when it dominates, it demoralizes. Like autocracy, it exploits those who maintain it; it misrepresents those who trust it; it seeks to destroy those who challenge it.

This statement was pertinent twenty years ago. Meanwhile, tradehouse control has almost disappeared. Consequently, the statement now seems exaggerated. But this marked difference in pertinence registers the great progress that has been made in the removal of intolerable conditions. On what is practically the twentieth anniversary of my initial public effort in this field, I heartily thank you for the opportunity, near the close of my active career, to serve the cause of truly professional journalism in dentistry in the post of highest distinction. I now transfer the president's duties to my distinguished successor, Dr. C. N. Johnson, the dean of dental editors, with cordial good wishes for his happiness as your servant; for the association's unbroken progress, and for the cumulative improvement of all branches of the journalism that truly represents the great and noble dental profession.

PROCEEDINGS OF THE SIXTH ANNUAL MEETING OF THE AMERICAN ASSOCIATION OF DENTAL EDITORS*

REPORT OF SECRETARY (ABSTRACT)

REPRESENTATIVES of twenty-two member publications attended the Sixth Annual Meeting of the American Association of Dental Editors. The following dental publications were represented: *Angle Orthodontist;* bulletins of the Colorado State Dental Association, Kings County (N. Y.) Dental Society, Pacific Coast Society of Orthodontists and Second District (N. Y.) Dental Society; *Contact Point; Dental Assistant; Dental News; Harvard Dental Record;* journals of the American Dental Association, American College of Dentists, Arkansas State Dental Association, California State Dental Association, Kansas State Dental Association, Michigan State Dental Association, Missouri State Dental Association, Oklahoma State Dental Association, and Southern California State Dental Association; the *New York Journal of Dentistry; Proceedings of the American Association of Dental Schools;* the *Journal of Dental Research* and the *Journal of Periodontology.*

The morning session was called to order by the president, William J. Gies, and the reports by officers and committees were presented. The secretary's report showed that during the short period since the last annual meeting, a total of fifty-four pages of mimeographed copy of syndicated articles for publication and most of the committee reports and papers read at the New Orleans meeting had been mailed to the membership. The treasurer's statement reported a balance of $603.56 in the treasury. The Executive Committee reported that, among other items, it had acted favorably on the establishment of a committee on dental student publications; the remission of dues of dental student publication members; an amendment to the bylaws providing for four classes of membership: publication, individual, associate and honorary. After the election of the new members, the membership roster showed a total of seventy-three publication, 143 individual and four associate members. Other committee reports which were heard during the morning session were those on membership, bylaws, program, cooperation and current dental literature.

A round table discussion luncheon session immediately following was presided over by C. N. Johnson, vice-president, who called on the discussion leaders selected by the program committee to direct the consideration of the following topics: "Developing Reader Interest," "An Editor's Job," "Business Management," "Component Society Letters" and "The Dental Index." Among the member dental editors of note who were present at the luncheon, was Dean Leroy M. S. Miner, at the time President-Elect of the American Dental Association. The points brought out by the discussions were of interest and value, chiefly to editors.

The afternoon session was called to

*San Francisco, Calif., July 11, 1936.

*Compiled by Grace Rogers Spalding, D.D.S., editor.

order by the president, who presented the main features of the Report of the Committee on Dental Student Publications, in the absence of the chairman, Eli H. Siegel. The secretary, Dr. Brandhorst read the report of the Committee on Advertising, in the absence of the chairman, C. W. Freeman, together with a proposal for a central advertising soliciting bureau. The report and the proposal were accepted and the Executive Committee was empowered to act. This has since resulted in the establishment of the Bureau of Associated Dental Publications.

C. W. Koch, editor of the *Journal of the Arkansas State Dental Association,* presented an exhibit to illustrate his suggestions for the improvement of dental publications as regards arrangement, cover, type, white space and advertising, which was constructive and practical.

Ingo Hackh read a brief paper on "Indexing and Reviewing Dental Literature." The essayist urged that the dictionary style of index be used in all dental publications to facilitate dental literary research and study. Dr. Hackh stressed the importance of critical dental reviews as an aid to improving dental literature, in addition to proper indexing for this purpose.

As has been the custom at the annual meetings of the association, the presidential address was preserved for the evening dinner session. Dr. Gies' address renewed interest in the ideals of the organization. George B. Winter, president of the American Dental Association, Ralph R. Byrnes, president of the American Association of Dental Schools, and William R. Davis, president of the American College of Dentists, were introduced, and responded briefly. The guest speaker of the evening was H. M. Mitchell of San Francisco, who spoke on "Publications Format." Mr. Mitchell had a fund of information, which he used generously in his lecture and later in response to numerous questions. Before adjournment, the following officers were elected: president, C. N. Johnson; vice president, Walter L. Hyde; secretary and treasurer, O. W. Brandhorst; editor, Grace Rogers Spalding.

COMMITTEE REPORTS (ABSTRACT)

The Committee on Cooperation, U. G. Rickert, chairman, reported that a number of articles, principally on dentistry for children, had been distributed to the members during the year. The committee also offered suggestions for increasing the income of nonproprietary dental journals, so that more space would be available for the publication of really worth while articles, which it was asserted were readily obtainable from authorities in special fields of dentistry. To delay activity along the proposed lines is, in the opinion of the committee, "impeding dental progress." It was recommended that a committee on cooperation be continued, not only to syndicate valuable articles, as originally planned, but also to cooperate with other committees aiming at the improvement of dental journalism.

The Report of the Committee on Current Dental Literature, T. F. McBride, chairman, represented the result of careful study and observation. A plea was made by the committee for greater liberalism in editorials and a more generous consideration for minority views. It was noted in the report that there had been a distinct advancement in realizing and assuming editorial responsibility. As of Nov. 1, 1935 (Commission on Journalism), there was a total of 124 dental periodicals, of which 105 were nonproprietary, eighteen proprietary and one unclassified.

While the general tone textually was

considered increasingly better, with more careful selection and with scientific aspects enhanced, attention was called to a too frequent rehashing of old material, with too little infusion of new ideas. As to the advertising policy, the committee recommended the whole-hearted support of the ideals on which the Council on Dental Therapeutics was founded, and the establishment of standards for the acceptance of advertisements, "truth in statement," "moderation in claims," "reputation," "integrity," "dignity" and "good taste." Undergraduate dental journalism should be fostered and stimulated by the Association as one of its responsibilities. The hopefully changing attitude of the profession, manufacturers and advertisers, in support of the ideals of professionally owned dental journalism, was commented on.

The Committee on Dental Student Publications showed that a surprising number of such periodicals are published in the United States. A thorough survey of the situation was made, and several constructive suggestions were given by the committee. Interested members of the association were urged to make contact with dental schools not publishing dental journals, and to take under consideration the advisability of establishing dental student publications in these institutions. It was recommended that the committee be continued and that the special interests of student journalists, among the future leaders of the dental profession, be promoted and furthered. An appendix accompanying the report contains detailed information concerning the various dental student publications.

REPORT OF CASES IN ORAL SURGERY*

By HARRY M. McFARLAND, D.D.S., Kansas City, Mo.

CASE 1.—A white woman, aged 22, with a cavernous angioma involving the right side of the face and extending into the oral cavity, and consisting of large endothelial lined spaces with thin walls and dilated blood vessels, had been treated by a consulting roentgenologist with discouraging results and was referred for surgical treatment.

Superficial nevus and cavernous angioma can be treated by the use of solid carbon dioxide, injection of boiling water, electrolysis or roentgen or radium therapy. Excision is advisable in cases wherein the incisions can be made beyond the dilated vessels and the edges of the wound subsequently approximated.

In this particular case, practically all of the foregoing methods of treatment were inadvisable, owing to the possibility of producing more disfigurement than was already present and of causing excessive loss of blood. Operation consisted of removing all of the teeth in the right maxilla and the central and lateral incisors on the left. Extensive alveolectomy was performed for the removal of the excessive amount of bone process and telangiectatic tissue. Since the primary purpose of the operation was cosmetic, special care was taken in preparing the alveolar surfaces for the prosthetist.

The amount of hemorrhage was con-

*Illustrated by a moving picture.

*Read before the Section on Oral Surgery, Exodontia and Anesthesia at the Seventy-Eighth Annual Session of the American Dental Association, San Francisco, Calif., July 16, 1936.

trolled by administering 2 drams of ceanothyn each day for three days before the operation, 1 in the morning and 1 in the evening, and 1 two hours before the operation.

One per cent procaine and epinephrine was the anesthetic of choice, in order to secure the definite constriction of the blood vessels.

CASE 2.—A white man, aged 38, was admitted to the hospital at 4 a.m., January 1, in shock, as a result of serious accident. The patient was seen at 5 p.m. the same day, at which time examination revealed that the maxillary bones were completely severed from the rest of the skull and the central and lateral teeth fractured, with roots remaining.

Symptomatic treatment was rendered and proper oral hygiene measures maintained. It was necessary to wait until the patient recovered from shock and the danger of meningitis and possible internal laceration of the brain had passed, before attempting reduction.

The roentgenographic examination, January 2, indicated fractures as follows: numerous fractures, including both sides of the maxillae, which were depressed posteriorly, and fractures of the pterygoid plates; fractures extending through the lateral walls of the antrum, and the caudal portions of the nasal bones were comminuted; fractures of the roof and floor of the right orbit, as well as in the zygomatic arch along the cribriform plate and greater wing of the sphenoid; comminution of the fragments in the frontal area.

COMMENT

The main problem was to deal with a transverse fracture that extended through both right and left maxillary bones. There was an abnormal distance from these bones to the base of the skull. The anterior portion of the maxilla was depressed upward and the posterior portion downward and altogether rotated to the left side.

In all cases, an effort is made to use as simple appliances as possible, as complicated apparatus tend to interfere with proper reduction. The equipment used in this case was necessarily quite complicated. In order to move the maxillary bones into their proper relationship with the rest of the skull, it was necessary to use an appliance that was fixed. Therefore, by use of the Kingsley arch, a suitable splint was constructed with attachments which would accomplish our purpose.

Better results are secured when it is possible to reduce the fracture within a few hours. In cases of fractures of the maxillary bones, we usually retain the appliances for about thirty days. Owing to the presence of a liberal blood supply, fibrous union takes place in this length of time. As it was necessary to wait fourteen days before reducing the fracture, there was the possibility of real union having already taken place. Therefore, the appliance was retained for nine weeks to assure that the bones remained in their proper relationship and the teeth in normal occlusion. This precaution would not have been necessary had it been possible to reduce the fracture soon after the accident.

Roentgenograms taken January 22 revealed that the maxillary bones were in correct relation and good alinement with the skull and that the teeth were in normal occlusion and the proper contour of the face was maintained.

THE PULP CANAL PROBLEM IN AMERICAN COLLEGES

By W. CLYDE DAVIS, A.M., M.D., D.D.S., Lincoln, Nebr.

THE facts as here presented were obtained as a result of a recent survey of American dental colleges, which I am making periodically to answer, if possible, many questions put to men in practice by their patients, by physicians and by certain other dentists.

The main question is "But what are our universities teaching the dental graduating classes at this time?"

This survey covers the last session; that of 1935 and 1936.

To each and every American dental college was mailed a return post card having thereon the following questions:

How many pulp canal cases is each student required to handle in order to graduate?

Give names of the medicaments or chemicals you have found most essential in pulp-canal therapy.

Give the total number (approximately) of pulp canal fillings made in your clinic in the session of 1935-1936.

What was used for permanent canal fillings?

We were able to secure the desired information from nearly all schools. The following totals are given.

Sixteen colleges have an average requirement of over seven pulp canal fillings for graduation.

The most required by any one college for graduation was twenty-five.

The least required was two.

Seven colleges have no set number.

In one college, the student has no pulp canal practice in the clinic.

One college requires eight cases for graduation and requires twenty-five cases of those doing postgraduate work.

One college evaded a direct answer, but stated, "Doing more than in previous years."

As to the total number of pulp canal fillings in the clinic for the session 1935-1936, the largest number in any one college was 1,500.

The smallest number was seventy-five, if we omit the one which had none and the one evading the question.

Of the drugs used, there were twenty-one distinct materials named. Not one mentioned arsenic.

There were six drugs named five or more times: eugenol, phenol, iodine, beechwood creosote, formocresol and chlorazene.

As to the materials used for permanent pulp canal filling, there is a great uniformity.

All but two use a guttapercha point in most cases. All but four use a medicated resinous varnish as a sealer for the guttapercha. One used a silver centered guttapercha canal point for very small canals.

Some of the return cards were accompanied by letters and detailed outlines of the courses given, giving step by step the results of the methods used.

With all this evidence, much of it from the best pathologic laboratories in America, it would seem that the adverse criticism sometimes offered by certain physicians and dentists is not based on full knowledge of the scope of the up-to-date dental curriculum.

TUMOR IN PALATE: REPORT OF CASE

By E. WILLIAMS, D.D.S., and J. E. WILLIAMS, B.S., D.D.S., Lafayette, Ind.

A MAN, aged 54, white, a grain dealer, in good health, i e., the physical findings were negative, came in July 24, 1932, for roentgenographic examination. In the maxillary areas, there were eight natural teeth, six of which served as abutments for three bridges. The right first molar and lateral incisor were pulpless; the right second bicuspid showed root-end rarefaction, and the other teeth were carious, the upper second molar, left, as an abutment tooth, being separated from its coronal and radial parts.

All the remaining upper teeth were extracted, July 24, under nitrous oxide-oxygen anesthesia. At this time, swelling was observed in the hard palate on the right side. A stab was made in this area, but no pus or fluid appeared. An anterior alveolectomy was performed, and an impression was taken for a denture. In two days, the denture was inserted. The swelling had increased in the palatal area and the denture did not seat itself.

Another impression was made and another denture was placed in the mouth. This was worn successfully until May 16, 1934. At this time, the palatal growth was removed under procaine anesthesia, through an incision extending from the median line posteriorly to the soft palate, and 5 mm. above the crest of the ridge. The bone appeared normal. The growth, which was found imbedded between the periosteum and the mucous membrane, was dissected and sent to the pathologist for examination, the report being as follows: Tissue fibrous with hyalin degeneration and fibroblastic organization; capillary lamination; areas of inflammatory cell infiltration; no purulent cell change; no hyperplasia of gland nor epithelial structures; surface shows fibrohyalin infarct organization apparently from previous inflammatory reaction; benign fibrous scar chronic.*

Although the etiology and the pathologic findings in THE JOURNAL[1] differ somewhat, the macroscopic findings are similar. The tumor that we removed did extend into the soft palate and did affect swallowing. There has been no recurrence, and the patient is using the denture constructed immediately after operation. Postoperative recovery was very satisfactory, and healing by granulation was complete in about forty-five days.

*F. P. Hunter, M.D.

1. Rein, C. R., and Feldman, M. H.: Mixed Tumors of Palate, J.A.D.A., 23:1310 (July) 1936.

THE JOURNAL *of the*
AMERICAN DENTAL ASSOCIATION
and THE DENTAL COSMOS*

212 East Superior St., Chicago, Ill.

C. N. JOHNSON, Editor
L. PIERCE ANTHONY, Associate Editor

Published by the American Dental Association

All expressions of opinions and all statements of supposed facts are published on the authority of the writer over whose signature they appear, and are not to be regarded as expressing the views of the American Dental Association, unless such statements or opinions have been adopted by the Association.

Communications intended for publication in the scientific or literary pages of THE JOURNAL should be addressed to the Editor. All advertising or business matter should be sent to the Business Manager.

Subscription is included in the annual membership dues. The subscription rate to non-members is $5.00 a year in advance, this rate applying to both domestic and foreign subscribers. All foreign subscriptions are to be paid in United States money.

*In deference to the wish of the dental profession to control its literature, The Dental Cosmos, founded in 1859, was transferred as a gift to the American Dental Association, January, 1937.

Editorials

OUR ASSOCIATE EDITOR

At the San Francisco meeting of the American Dental Association, as already announced in THE JOURNAL, the S. S. White Dental Mfg. Co. tendered *The Dental Cosmos* as a gift to the Association, and it was accepted by the Board of Trustees. The former editor of *The Dental Cosmos,* Dr. L. Pierce Anthony, was made Associate Editor of the combined publications.

Accordingly, January 1, Dr. Anthony came to the Central Office of the A.D.A. and assumed his duties with the organization. It is our pleasure at this time to extend felicitations to our new Associate Editor, and bid him a hearty welcome into our official family. In his editorial capacity in the past, Dr. Anthony has displayed rare judgment, and has demonstrated his eminent fit-

ness for this kind of service. He has the broad editorial vision, and the background of many years of valuable experience.

We feel that it is a distinct asset to the Association to have the benefit of Dr. Anthony's wise counsel and cooperation, and we trust that in his new work he may find himself in a congenial environment, where his eminent abilities may serve to extend the usefulness not only of the Association, but also of the entire dental profession.

"DENTISTRY WRITTEN OUT"

On one occasion, a dental editor resigned his position on the ground that dentistry was written out and that there was nothing more to be said on the subject. The man was actually serious about it.

Probably he was right, as far as he was concerned. Probably he had reached the limit of his own mentality, and really was unable to go any farther. If that were true, he was wise to do as he did. Nothing is more fatally foolish than for a man to assume a knowledge that he does not possess.

But the pertinent thing in the situation is that, since the man made the remark, more things of real moment to dentistry have been brought out than had ever been known up to the time the remark was made. And some of them were just in the offing at that very moment, only he could not see them. He lacked vision, like many other men.

He must have known something about pulp canal work, but assuredly he had no conception of the extent to which the treatment of pulp canals was to be carried, and the scientific study that was to be given the subject in the near future. It must have been shortly after he resigned that a rather extensive literature was built up on this subject.

It was not his fault that the introduction of the roentgen rays had not yet taken place, but it was assuredly a hazardous prediction for him to make that there was to be nothing further to engage the attention of the profession. He should have known that

advancement never ceases, and that the lure of new things is one of the greatest incentives of life. The roentgen rays have done more to enlighten men on some of the hitherto hidden mysteries of our work than had ever before been dreamed of. How helpless we would feel today without the roentgen rays, yet such are our human limitations that when we first began their use, we did almost as much harm as good with them. The pictures were imperfect and sometimes misled us, and, worse than that, our interpretation was faulty. And the situation is not all remedied yet. We have a long way to go before roentgen-ray work is brought to perfection. In fact, it was a very learned man—Edison, so it is claimed—who said that we do not yet know the millionth part of *anything*. This should be incentive enough for further study.

At the time our friend the editor asserted that dentistry was written out, the cast gold inlay had never even been heard of. Volumes have been written on it since then, and more volumes are being written today. And more volumes will be written on it in the future, and profitably so. This subject has absorbed our professional interest to an extent that was unpredictable, and it has modified dental practice beyond belief. It has added immeasurably to the comfort and efficiency of dental practice, and has served the profession and the people in ways that could never have been achieved without it.

Of course, the subject of dental caries had been discussed, and equally of course nothing very definite had been established. Enough literature on dental caries has been produced to justify an absorbing interest in the subject, and more and more will continue to be produced till such time as the question is solved.

Other subjects of passing interest have from time to time been brought out to claim the attention of the profession, all of them demanding that thought be given them.

Dentistry written out! We are only beginning. We have merely caught a ray of light here and there, just a feeble glimmer of the great effulgence that floods the horizon of the future if we could only see it. Dentistry written out! The pathos of such a remark! The essential folly of it! "Where there is no vision, the people perish."

Dentistry shall never be written out till such time as the last remnant of dental disease is winnowed from the consciousness of mankind, the last painful tooth has been relieved and cured, the last deformed countenance of every pathetic little child has been molded into lines of symmetry and beauty, the last shrunken jaw of senility has been restored to fullness of form and efficiency of function. Even then, dentistry will never be written out. And it will not be written out till such time as all of these disabilities have been traced to their source, and the blessing of prevention has become an established fact, when men are no longer threatened by the menace of pain or the fear of deformity, when men, women and children have come fully into the kingdom of health and happiness, and the fullness of life has been vouchsafed to every son and daughter of man.

And this will be a very long time in the future. Dentistry written out—oh, no!

THE PATIENT'S DILEMMA

The following communications speak for themselves: an accurate reproduction of certain correspondence, with indentification hidden. What solution of the situation would you have suggested?

To the Editor:

At my family dentist's suggestion, I am taking the liberty of writing you of a predicament in which I find myself.

This summer my son, aged 3½ years, fell and knocked out an upper front tooth. The adjoining tooth became loose and discolored. We took the boy to our family dentist, who took x-ray pictures. He decided that the tooth was dying and recommended us to a leading orthodontist for consultation.

Dr. A, the orthodontist, took more x-rays and decided that the tooth must be drawn and the bone should be scraped, as he was certain that there was a diffused abscess. Following extraction, he advised the installation of one of two kinds of appliances to retain the space between these first teeth as he assured us that the teeth would gradually grow together and interfere with the proper growth of the second teeth. Dr. A was prepared to install a space retainer consisting of a wire running along the inside of the upper arch fastened to the last molars with two false teeth to be strung on the wire at the open space. Although, as I understand it, this is the specific work of an orthodontist, he advised us not to have the space retainer as de-

scribed above, but suggested that we take the child to another city to a specialist in construction work. According to Dr. A, this specialist had developed a new technic which, in a word, would consist of a space retainer with false teeth, but attached only to the adjoining teeth rather than running the length of the upper arch. This, Dr. A claimed, was only being done by this one specialist. I was at a loss to understand why Dr. A did not do this orthodontic work himself since he considered it the superior method.

Nevertheless, we took the child to Dr. B, considered the leading extractionist in that city. He immediately said on seeing the x-rays that the tooth should come out and forthwith extracted it. However, he assured us that there was no abscess and no need to scrape the bone as he was certain that any infection there might have been would be absorbed after removal of the tooth.

In view of these seeming contradictions, my wife asked Dr. B to recommend another orthodontist. Dr. B suggested a Dr. C. Dr. C, on examination of the x-rays and the child, saw no need for a space retainer, claiming that the growth of the upper jaw would give the teeth a tendency to spread rather than to grow together. He suggested an entirely different appliance to widen the upper jaw bone, claiming that the child's second teeth as seen in the x-ray pictures appeared much too large for the space provided by Nature and crowding would result. Dr. C took measurements of the space and suggested we return in six months' time to establish the rate of bone growth. There was, however, very little chance in his eyes of sufficient growth to allow for the second teeth to come down properly.

Having our child's welfare perhaps too much at heart and being completely confused by contradictory opinions, we went to a third equally well-known orthodontist, Dr. D.

He immediately suggested a space retainer such as Dr. A considered inferior to the new technic used by the specialist (B) mentioned above, but similar to the kind that he himself could have installed.

We are totally at a loss as to how to proceed, being inclined to believe that when specialists of the caliber of these men disagree possibly it is the best policy to let Nature take its course.

I will appreciate sincerely any suggestions that you might care to make.

The answer was as follows:

Dear Mr. ——:

Your favor of December 22 has just come to my desk.

First, in the strictest justice to all parties concerned, I think I should assure you on the basis of the statements made in your letter, and in full accord with the natural confusion of mind in which you find yourself, as well as your reasonable anxiety concerning the welfare of your child, that I can see not the slightest ground for suspecting that in each individual case the general practitioner and the specialist acted in anything but the most perfect good faith.

Please remember that any diagnosis from a written description is far from conclusive and I am saying this in the absence of x-rays or models, but even if these were available, there is no assurance that they would throw the necessary light on the case. No one is infallible in such matters, and it must ultimately come down to a question of opinion.

The greatest promise of accurate judgment in such a situation is usually found in consultation between several men with the child under observation.

To relieve your anxiety and contribute to your peace of mind, I feel that I can assure you that there is no serious cause for apprehension. At the age indicated and with the natural solicitude that everyone connected with the case must manifest, a careful scrutiny of the child as time goes on will indicate without any question the proper procedure.

One thing I would consider essential: If the space caused by the missing teeth seems to be growing perceptibly narrower, I would advise maintaining the space and possibly slightly widening it.

Trusting that your child's mouth may ultimately grow into perfect symmetry, and that you and the mother may thereby be relieved of anxiety, I am

Very sincerely yours.

SALVE!

In assuming the duties of our new relation to organized dentistry we are fully mindful of the honors, as well as the obligations imposed upon us, as the Associate Editor of THE JOURNAL. With due sense of appreciation of the confidence implied in the act of the Board of Trustees in choosing us to assist in forwarding the influence and scope of its literary mouthpiece, we sincerely trust that we may bear our honors modestly, and look forward with pleasurable anticipation to the opportunity of contributing in a measure to the promotion of the aims and purposes of dentistry in its efforts toward the health and well-being of the nation.

While the journalistic experience and training of the new Associate Editor have been acquired in association with a journal that was not an integral part of organized dentistry, yet the purposes and aims of the two efforts were so similar that we do not anticipate any particular difficulty in adapting ourself to a closer relation to the official body of the profession. And while the policies of the two journals have been different in some aspects, the new Associate Editor hastens to assure the readers of the combined journal that our main purpose will be a conscientious effort and aim to continue and support the policies and practices which have been so ably administered by the distinguished Editor of the Journal of the Association.

We say this for the reason that we have already received letters from life-long *Dental Cosmos* readers who have called attention to the fact that they have received copies of the merged journal, but see no change from its regular form. We can only urge such commentators to familiarize themselves with the numerous valuable features of the organization journal and to keep in mind the amenities of precedence in such a merging of interests of the two journals as has just been effected. *The Dental Cosmos,* as such, has passed into history, but the new Associate Editor will endeavor in so far as seems desirable to keep alive the best traditions of the *Dental Cosmos.*

The new Associate Editor is fully conscious of the magnitude of the responsibilities and obligations which his new relationship involves, and in his endeavor to fulfill the high expectations of his many solicitous friends, he relies in great measure upon the thoroughness of the schooling which he received under the most capable tutorship of his predecessor in the editorial conduct of the *Dental Cosmos,* as well as upon the generosity and forbearance of the delightful friendships he has developed during his editorial affiliations.

Becoming more closely associated with the presentation of the literary output of the representative body of the profession, and in a more or less directive capacity, it may be appropriate at this time to set forth our conception of the function of the journal as an ancillary effort in promoting the educational aspect of dentistry.

At the time when the writer first became associated in an editorial capacity with the *Dental Cosmos,* there was a constant and insistent urge from its readers for more and more of what was designated as practical articles on dental subjects. The scientific aspect of dental practice was then aborning as the result of the realization on the part of some of its more advanced thinkers that dentistry, in order to attain its proper status as a branch of the healing art, would be compelled to develop its scientific justification for a place among the biologic sciences. The then Editor of the *Dental Cosmos* had already sensed the desirability of such a course and had already begun to direct his editorial efforts

toward the promotion and popularization of the scientific method of thought and practice as the *raison d'être* for the so-called practical method.

The almost immediate beneficial results accruing from the adoption of such a course and the soundness of the doctrine that the practical must be based upon the scientific were so thoroughly impressed upon the mind of the writer, and its saneness and desirability so confirmed by subsequent development of the science and art of dentistry, that he has endeavored thenceforth to adhere to that policy to the best of his ability. So firm had become our conviction of the soundness of that policy that we had almost come to the belief that the apparent benefits resulting therefrom had converted the entire profession to the scientific ideal.

It would seem, however, that there are still some who cling to the fallacy that there is a line of distinction between the scientific and the practical. Science is well defined as "knowledge gained and verified by exact observation and correct thinking, especially as methodically formulated and arranged in a rational system." Measured by this standard, then, it must follow that dental literature which conveys accurate, verified knowledge of the principles and practice of dental procedures that has been determined by scientific proof is surely the most practical way of gaining dental knowledge.

The empirical and indiscriminate application of mechanical principles to restoration of the mouth tissues, with little or no consideration of the physiologic and hygienic needs of the case, stands out today as probably the most colossal error ever committed by any specialty of the healing art. The lesson learned from the disease and distress left in the train of such empirical practice has, however, been a most wholesome one, in that it brought about a reversal of policy and practice and eventuated in the inauguration of extensive scientific research, fostered by the American Dental Association, into practically every phase of dental practice.

The benefits to the profession from the promotion of scientific research have fully justified the course and also fully justify the belief that aiding in the development of dental practice along

scientific lines is the most laudable aim and function of the periodical literature of dentistry.

It is thus with a spirit of humility and in full recognition of our shortcomings that we become actively affiliated with the continuance of a literary effort which has thus far been so conspicuously successful.

L. P. A.

PRACTICE IN PARAGRAPHS

This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.

Use of Wings from Bitewings—Wings can be cut from a large bitewing roentgen-ray film and used as regular films.—*Charles C. Norris, Oshkosh, Wis.*

Roentgenography—The patient can assist the dentist by holding a book securely against the chin while roentgenograms are being taken.—*Charles C. Norris, Oshkosh, Wis.*

Shaping Cotton Rolls—Cutting cotton rolls No. 1, 2, 3 in parallelograms with two very acute angles instead of rectangles makes for greater comfort for the patient.—*Harry A. Paskow, Elizabeth, N. J.*

To Remove Silver Nitrate Stains—Someone has suggested that sodium perborate will remove iodine stains. To remove nitrate of silver stains, the area is first painted with tincture of iodine and then sponged with or soaked in a solution of sodium perborate.—*J. W. Peroutky, Merrill, Wis.*

Dark Room for Developing Roentgen-Ray Films—By the use of one or possibly two light-proof shades, almost any room can be made perfectly dark and can serve as a dark room for developing roentgen-ray films. A small cabinet can be easily made that will serve for developing. A glass top is used, as wood warps.—*Charles C. Norris, Oshkosh, Wis.*

Inserting Cement in Cavity—When inserting a cement step or cement base in a cavity, if the plastic instrument is first plunged in alcohol and then used to place the cement, it will be found that the cement does not adhere to the instrument while molding into place. Much time will be saved and better adaptation be secured.—*Gerald J. Gabriel, Ancon, C. Z.*

Removing Contents from Hypodermic Needle—To remove the contents from a hypodermic needle, the rubber is removed from a medicine dropper and the hypodermic needle is stuck through one end of it. Either the tip of an air syringe or the spray bottle attachment is placed in the open end of the rubber and air is blown through the needle.—*F. D. Voigt, Salem, Ore.*

Removing Gum Flap—Fibrous gum flap over erupting molars can be removed quickly and with little pain by making a snare of a dentimeter and ligature wire, wrapped tightly on a little cross stick. With the thumb on the end of the dentimeter handle and two fingers on the little cross piece, the tissue is clipped off smooth. It can be worked back under the flap and will not leave ragged edges.—*Claude A. Moore, Lexington, Miss.*

Developing Roentgenograms—In developing roentgenograms, a positive can be made from the negative film for reference to the physician for interpretation, the positive being better and clearer. With the ordinary velox paper sold in photographic supply houses, the negative is placed on paper and held up to the light, in the dark room, for ten seconds and then developed exactly as a negative in developing and fixing solutions. The result will be surprising, the positive being very clear. The full mouth roentgenograms are mounted for the physician's examinations, and the expense of celluloid mounts is saved.—*Harry A. Paskow, Elizabeth, N. J.*

Importance of Clean Teeth—Cleaning of the teeth is perhaps one of the most important operations the dentist performs. Twenty-five years ago, patients were instructed to report at this office every six months to have their "teeth cleaned." Looking back over twenty-five years, I find that many of the patients, from 5 to 75 years, having visited the office at six month intervals, still have nearly full arches, and an absence of gingivitis and peridentitis. Many patients today are instructed to have the teeth cleaned every three or four months if there is a tendency to prolific calcium deposits.—*Calvin William Knowles, 177 Post Street, San Francisco, Calif.*

The Pledge—If you wish to increase the size of your practice, take the pledge—a pledge to cause no pain. Say to yourself: "I pledge myself to cause no pain to any patient" and keep that pledge to the best of your ability. Make a test to assure yourself of anesthesia before every extraction under procain and, if necessary, inject again. If you hurt a patient, he will look for a dentist who will not hurt him and, worse still, he may keep others from coming to you. If you do not hurt a patient, he will return, and, better still, he will refer others. Some years ago, I took this pledge, and since then I have been very much pleased by the results. That my practice has held up well during the depression I attribute largely to this.—*A. Porter S. Sweet, Hornell, N. Y.*

COUNCIL ON DENTAL THERAPEUTICS

ACCEPTED DENTAL REMEDIES

The following articles have been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association. The Council wishes dentists to understand that the admission of an article does not imply a recommendation. A copy of the rules that govern the Council in the consideration of articles will be sent on request.

SAMUEL M. GORDON, *Secretary.*

ANESTHETICS—LOCAL*

Novocain Solution 2.2% with Cobefrin 1:9000-Cook.—Each cubic centimeter is stated to contain novocain, 0.022 gm., cobefrin hydrochloride, 0.00011 gm., acetone sodium bisulfite, not more than 0.0022 gm., potassium sulfate, 0.0022 gm., sodium chloride, 0.0011 gm., and distilled water. This is accompanied by a sodium bicarbonate solution, each cubic centimeter of which is stated to contain sodium bicarbonate, 0.035 gm., and distilled water. When Novocain Solution 2.2% with Cobefrin 1:9000 is treated as directed with the sodium bicarbonate solution, there is obtained an isotonic solution with a p_H of 7.4, having the following composition per cubic centimeter: novocain, 0.02 gm. (2 per cent), cobefrin hydrochloride, 0.0001 gm., acetone sodium bisulfite, not more than 0.002 gm., sodium chloride, 0.001 gm., potassium sulfate, 0.002 gm., sodium bicarbonate, 0.0035 gm., and distilled water.

Manufactured and distributed by Cook Laboratories, Inc., New York City. U. S. patents applied for.

Novocain Solution 2.2% with Cobefrin 1:9000-Cook in cartridges, 2-2.5 c.c.

Sodium Bicarbonate Solution in cartridges, 2-2.5 c.c. (One cartridge of sodium bicarbonate solution contains sufficient sodium bicarbonate to alkalinize ten cartridges of the novocain-cobefrin solution.)

Novocain Solution 2.2% with Cobefrin 1:9000-Waite.—Each cubic centimeter is stated to contain novocain, 0.022 gm. (2.2 per cent), cobefrin hydrochloride, 0.00011 gm., potassium bisulfite, 0.000506 gm., glycerin, U.S.P., 0.125 c.c., ortho and para mono-iodo-phenols, 0.0002 gm., potassium iodide, 0.00015 gm., and distilled water. This is accompanied by a compound sodium bicarbonate solution, each cubic centimeter of which is stated to contain sodium bicarbonate, 0.05 gm., glycerin, U.S.P., 0.125 c.c., ortho and para mono-iodo-phenols, 0.0002 gm., potassium iodide, 0.00015 gm., and distilled water. When the novocain solution (2.2%) with cobefrin 1:9000 is treated as directed with the compound sodium bicarbonate solution, there is obtained an isotonic solution with a p_H of 7.4, having the following composition per cubic centimeter: novocain, 0.02 gm. (2 per cent), cobefrin hydrochloride, 0.0001 gm., potassium bisulfite, 0.00046 gm., glycerin, U.S.P., 0.125 c.c., ortho and para mono-iodo-phenols, 0.0002 gm., potassium iodide, 0.00015 gm., sodium bicarbonate, 0.005 gm., and distilled water.

*A.D.R. 1935, p. 34.

Manufactured and distributed by Antidolor Mfg. Co., Inc., New York City. U. S. patents applied for.

Novocain Solution 2.2% with Cobefrin 1:9000-Waite in cartridges, 2-2.5 c.c.

Compound Sodium Bicarbonate Solution in cartridges, 2-2.5 c.c. (One cartridge of compound sodium bicarbonate solution contains sufficient compound sodium bicarbonate to alkalinize ten cartridges of the novocain-cobefrin solution.)

Procaine Solution 2% with Epinephrin 1:50,000-Proco-Sol Brand.—Each cubic centimeter is stated to contain procaine hydrochloride, 0.02 gm., epinephrine, 0.00002 gm., sodium chloride, 0.0007 gm., chlorbutanol, 0.005 gm., sodium bisulfite, 0.0019 gm., and distilled water.

Manufactured by Proco-Sol Chemical Co., Inc., Philadelphia, Pa. No U. S. patents or trademarks.

Procaine Solution 2% with Epinephrin 1:50,000-Proco-Sol Brand in cartridges, approximately 2.5 c.c.

Procaine Solution 2% with Epinephrin 1:25,000-Proco-Sol Brand.—Each cubic centimeter is stated to contain procaine hydrochloride, 0.02 gm., epinephrine, 0.00004 gm., sodium chloride, 0.0007 gm., chlorbutanol, 0.005 gm., sodium bisulfite, 0.0019 gm., and distilled water.

Manufactured by Proco-Sol Chemical Co., Inc., Philadelphia, Pa. No U. S. patents or trademark.

Procaine Solution 2% with Epinephrin 1:25,000-Proco-Sol Brand in cartridges, approximately 2.5 c.c.

CALCIUM COMPOUNDS†

Tricalcium Phosphate with Sodium Pyrophosphate, 2½% Victor‡.—Tricalcium phosphate with sodium pyrophosphate consists of tricalcium phosphate-Victor to which has been added from 2 to 2.5 per cent of anhydrous sodium pyrophosphate, $Na_4P_2O_7$. The sodium pyrophosphate is added to promote wetting of the tricalcium phosphate.

Prepared by Victor Chemical Works, Chicago, Ill. Patent pending. No U. S. Trademark.

TOXIC POTENTIALITIES OF A FLUORIDE DENTIFRICE

In an earlier report, the Council called attention to the granting of patents for dental articles after what appeared to the Council to be inadequate scientific study (J.A.D.A., 21:1494 [Aug.] 1934).

More recently, a patent has been issued by the U. S. Patent office for a dentifrice which is stated to contain, as one of the important ingredients, sodium fluoride. Claims that it will whiten teeth by virtue of the fluoride content are permitted. These allowed claims were investigated at the request of the Council by a qualified collaborator in the laboratory of a member of the Council, because (1) a patent for an essentially toxic substance in a dentifrice was issued, and (2) it was believed that the attention of the profession should be called to the presence of potentially toxic substances which appear in dentifrices from time to time.

The Council accepted the report of its collaborator with a note of appreciation for the careful manner in which the work was carried out, and authorized its publication.

SAMUEL M. GORDON, *Secretary.*

The object of this report is to present results on growth rate and the incisors of the albino rat from feeding a tooth paste (U. S. Pat. No. 1,943,856) as evidence of toxic potentialities of fluoride, said to be a constituent of the product.

Roy Cross, Kansas City, Mo., assignor to Silica Products Company, Kansas City, has

†A.D.R. 1935, p. 69.
‡See A.D.R. 1935, p. 79.

secured U. S. Patent No. 1,943,856 on a dental preparation with the following composition:

Bentonite	50 parts
Magnesium oxide	50 parts
Sodium fluoride	1 part
Sodium phosphate	5 parts (acid or basic?)
Soap powder	5 parts
Oil of eucalyptus	1 part
Gum camphor	1 part
Tincture of benzoin	5 parts

Water in sufficient quantity to give a paste of the right consistency.

Samples of Cross' product were not available for toxic tests and, therefore, a mixture was prepared according to the composition as stated.

PROCEDURE

In compounding this mixture, the sodium fluoride, bentonite, magnesium oxide and soap powder were thoroughly mixed. The camphor, eucalyptol and tincture of benzoin were thoroughly dissolved. The two mixtures were then combined and well mixed in a mechanical mixer. For the purposes of the experimental tests to be described, the water was omitted from the formula. The inventor does not state whether acid sodium phosphate or disodium phosphate should be used. Since the resultant mixture is alkaline in reaction, acid sodium phosphate would be converted to disodium phosphate. The use of acid sodium phosphate would put more phosphate into the mixture and in the belief that the inventor would have no objection to using the maximum amount of the bone building phosphate for rubbing on the gums, the acid salt was used.

It will be seen that the foregoing formula contains about 0.8 per cent sodium fluoride before water is added to form a paste. The proposal to apply such a concentration of sodium fluoride to the mouth one or more times daily is not to be considered lightly, in view of the known toxic actions of fluorine. Hence, this investigation of the possibility of chronic fluorine poisoning was undertaken.

That fluorine can cause chronic poisoning has been amply demonstrated.[1] One part of fluorine in 1,000,000 parts of water has been shown to be sufficient to cause mottling of the teeth in children. Fourteen parts of fluorine in 1,000,000 parts of food has been shown[2] to produce bleaching of rat incisors.

The possibility of deleterious effects from fluorine in the above-mentioned tooth paste formula was tested by feeding female albino rats well-balanced diets to which definite concentrations of the tooth powder were added. The growth curves of the rats were determined and compared with the growth curve of normal female albino rats. At the same time, bleaching of the incisor teeth was watched for, since this effect is a delicate criterion of fluorine toxicity.

Details of the experiments on the lower dosage levels will not be discussed, since the results were surprisingly negative. Only the two highest dosage levels need be considered.

RESULTS

Starting with a weight of approximately 50 gm., control female rats gained about 100 gm. during the first two months, about 20 gm. in the second two-month period and about 10 gm. in the third two-month period. Female rats on the same diet, to which tooth

1. DeEds, Floyd: Chronic Fluorine Intoxication (A Review), Medicine, 12 (Feb.) 1933. DeEds, Floyd, and Thomas, J. O.: Comparative Chronic Toxicities of Fluorine Compounds, Proc. Soc. Exper. Biol. & Med., 31:824-825, 1934. Smith, Margaret C.; Lantz, E. M., and Smith, H. V.: Univ. Arizona Col. Agr. Tech. Bull. 32, 1931.

2. Footnote 1, first reference.

powder had been added, so that 96 parts of fluorine per million parts of food were present, grew at a somewhat slower rate. The effect on growth was too small to be significant. Pregnancies took place; whereas, addition of the same concentration of sodium fluoride to the diet in the absence of the other ingredients permitted very few, if any, pregnancies. Evidently, the fluorine of the tooth powder was not absorbed.

Fourteen parts of fluorine per million parts of food will cause bleaching of the incisor teeth in young growing rats, but 96 parts of fluorine, as an ingredient in the above-mentioned tooth powder, failed to show bleaching during two months of feeding. Double the dose, or 192 parts of fluorine per million parts of food, did produce a detectable bleaching by the end of the next month. This quantity of fluorine is 14 times the quantity necessary to produce bleaching of rat incisors.

Since the proposed tooth paste is alkaline in reaction and contains magnesium oxide, magnesium fluoride may be formed, and this salt may actually be present in the dentifrice because of its low solubility product. The low solubility of 0.0087 per cent at 18 C., and the alkaline reaction of the digestive tract, may account for an extremely low absorption of fluoride and thus for the negative results obtained.

COMMENT

In spite of the failure to produce bleaching of rat incisors with reasonable amounts of the poisoned tooth powder in the diet, the inclusion of sodium fluoride in the formula is irrational and should be discouraged. The claims that sodium fluoride in the preparation bleaches the teeth is based on false premises. Bleaching of human teeth by fluoride occurs only in children prior to eruption of the permanent teeth. The mechanism depends on an internal physiologic action. No effect is produced on the enamel of permanent teeth subsequent to eruption. Ammonium fluoride is used in dental practice to whiten teeth, but this action on external application to the teeth depends on an etching effect of the ammonium fluoride, which is acid in reaction. Such an action would not occur with sodium fluoride added to a tooth paste which is alkaline in reaction. As shown by the investigation of Sharples and McCollum,[3] fluorine is not an essential element in tooth structure, and even if it were essential, it could not be supplied by rubbing on the tooth surface. A rational scientific basis for the use of sodium fluoride in tooth paste does not exist.

Despite the fact that the results as to toxicity of this commercial product were essentially negative, it does not follow that the product is necessarily innocuous or at least free from toxic potentialities under all possible dental conditions. For example, local absorption of the fluoride might be promoted by massage of the gums with the aid of a toothbrush, and by the presence of pathologic conditions, such as ulcers, inflammatory states, pus pockets and the like. In other words, uncontrolled usage of the product by the laity might still result in undesirable systemic reactions, especially in children.

CONCLUSIONS

1. The fact that a patented fluoride dentifrice was not demonstrably toxic when tested for typical fluoride toxicity in feeding experiments on rats does not mean that this dentifrice is not potentially toxic under all dental conditions.
2. Conditions of dental usage and pathologic states in the mouth might promote absorption of fluoride and toxicity.
3. The use of fluoride in dentifrices is unscientific and irrational, and therefore should not be permitted.

3. Sharples, G. R., and McCollum, E. V.: Is Fluorine an Indispensable Element in Diet? J. Nutrition, 6:163-178, 1933.

EL-CRE-SOL—NOT ADMISSIBLE TO A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Dr. Chalmer's El-Cre-Sol Formula is stated in advertising in *Dental Survey* to be "The Surest Medicament Known for VINCENTS PYORRHEA CANKER SORES BLEEDING GUMS." A 15 c.c. bottle sells for $2.25. It is stated to be sold on a money-back guarantee.

Inquiries concerning this preparation have been received by the Council. A circular from the package states that El-Cre-Sol is "FOR ALL DISEASES OF THE MOUTH." It is stated to be ". . . sulphonated pure Beechwood Creosote scientifically prepared with Oxygen for treating all inflamed conditions of the mouth."

The directions for the treatment of Vincent's infection and pyorrhea and bleeding gums with the product show a naiveté concerning the character of these conditions. In the treatment of Vincent's infection, which is stated to respond "readily to treatment with El-Cre-Sol," the product is applied with a syringe "to all ulcers, follow gingival line around teeth, and insert into all pockets." Further instruction is to "rinse mouth with bicarbonate of soda water." The treatment is again administered on the third and sixth days, and then as often as the case demands until the gums appear normal. Little is said about the operative procedure, which appears to be the essential part in all treatment of Vincent's infection.

Cases of pyorrhea "even those of long duration—can be cleared up and gums restored to normal healthy state with EL-CRE-SOL." Further, it is said that "this treatment allays the inflammation of dental periosteum and after necrosis is destroyed loose teeth again become solid."

Even more naive are the directions for treating bleeding gums. It has been mentioned elsewhere by the Council that bleeding of the gums may be symptomatic of serious constitutional conditions such as agranulocytic angina, or, as it has been shown, may be related to hormonic influences. (J.A.M.A., 105:904 [Oct. 14] 1935.) Treatment of such cases of gum disease with a preparation like El-Cre-Sol, without adequate diagnosis, is in the interest of neither the profession nor the public.

Treatment of gum disease with a product of the composition of El-Cre-Sol represents the crudest form of drug therapeusis. The report which follows shows that El-Cre-Sol as used by the dentist contains as essential ingredients approximately 25 per cent sulfuric acid and approximately 10 per cent sulfurous acid. It is probably the result of a carelessly controlled admixture of Beechwood creosote and sulfuric acid. The part that oxygen plays in the preparation is hard to discern.

As will at once be recognized from the chemist's report, El-Cre-Sol is essentially no different than Debacterol, which has been the subject of a report by the Council. (J.A.D.A., 22:1970 [Nov.] 1935.) It again illustrates the lack of originality of nostrum manufacturers.

The report of the chemist follows.

One original package of Dr. Chalmer's El-Cre-Sol Formula (The El-Cre-Sol Laboratories, Kansas City, Mo.), price $2.25, was received for examination.

The following appeared on the label:

EL-CRE-SOL is sulphonated pure Beechwood Creosote scientifically prepared with Oxygen. It contains no harmful ingredients, no metal salts, nor any form of arsenic, silver, or mercury.

The package contained approximately 15 gm. of a black, tarry, semiviscous liquid with

a predominating odor of sulfur dioxide and a faint phenolic odor. Black particles were suspended in the liquid.

The product was acid to litmus. It was partly insoluble in water, and black particles were suspended in the water.

Qualitative tests indicated the presence of sulfur dioxide, sulfate, phenolic bodies and carbonaceous material.

Quantitative determinations yielded the following:

Acidity as sulfuric acid	35.1 per cent
Sulfate (as H_2SO_4) gravimetrically	24.4 per cent
Sulfite (as H_2SO_3) gravimetrically	9.7 per cent
Phenolic compounds (as C_6H_5OH)	3.8 per cent

From the foregoing, it may be concluded that El-Cre-Sol as purchased is essentially an aqueous solution of sulfuric and sulfurous acid in which carbon particles are suspended. It is probably the end-result of the interaction of sulfuric acid on phenolic compounds.

BEECHNUT ORALGENE CHEWING GUM— NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Milk of magnesia has long been one of the standard laxatives. Its laxative properties are primarily dependent on the magnesium ion produced therefrom. Because of its alkaline nature it was introduced as a constituent of tooth paste and later of tooth powder to overcome presumably so-called acid conditions of the mouth.

The Council has already expressed reasons for not expecting milk of magnesia to exist in a tooth paste or tooth powder. (J.A.D.A., 23:1566 [Aug.] 1936.) In all likelihood, a product approximating the composition $Mg(OH)_2$ is used. The invariable claim made by the promoters of such dentifrices has been that it helps correct "mouth acidity."

The latest application of commercial science in this direction is the incorporation of magnesium hydroxide in a chewing gum specifically made "for the teeth." Beechnut Oralgene Chewing Gum with Dehydrated Milk of Magnesia is put out by the Beech-Nut Company, and it is intended to be chewed with a purpose. That purpose, as any dentist will tell you, according to an advertisement for Oralgene, is:

1. Gives teeth and gums exercise that modern foods cannot provide. All chewing gum helps but the firmer texture of Oralgene is particularly valuable.
2. It helps clean the mouth by removing food particles that even your toothbrush misses.
3. It helps correct mouth acidity all the time you are chewing.

There is no evidence that is deserving of the name available to the Council that chewing Oralgene, or any other chewing gum for that matter, gives the gums exercise that "modern foods cannot provide." It has not been scientifically demonstrated that chewing with Oralgene benefits in any definite way the teeth, the gums or the jaws. It is possible that chewing gum may remove food particles that are suspended in saliva, but the efficacy of chewing gum to remove food particles which adhere to the teeth has not been demonstrated by carefully controlled evidence. As for the third claim, of correcting acidity, it is high time that advertising copy writers should know that the acidity or alkalinity of the mouth cannot be expected to be materially changed for an appreciable length of time by the presence of induced substances, even such insoluble materials as magnesium hy-

droxide. The grand average of all p_H determinations on the saliva of the mouths of different persons shows that the reaction is slightly acid, but close to the neutral point. Furthermore, the individual reaction normally varies over a wide range. No correlation has been proved between the so-called mouth acidity and either caries or pyorrhea. No one has brought forward evidence that the average mouth, to which undoubtedly such advertising as Oralgene is directed, will benefit by the continued chewing of chicle mixed with milk of magnesia. The sooner such unsubstantiated claims are discontinued, the sooner will people appreciate that proper care of the teeth and gums depends on individual examination and such corrective measures as are necessary. Chewing gum combined with milk of magnesia can be considered neither as a preventive nor as a reparative measure.

For these reasons, Oralgene Chewing Gum is declared unacceptable for Accepted Dental Remedies.

The Introduction of New Drugs

What, then, are the fundamental considerations in the introduction of a new drug or preparation? 1. The composition must be known, including adequate evidence of composition and molecular structure. Impurities must be eliminated by appropriate tests. An approved method of assay is necessary in order that pharmacologic and clinical work may be comparable. In case of biologic products, other methods of control and assay must be substituted as, for instance, "insulin units." 2. The action on experimental animals should be studied by a competent pharmacologist. This is important not only for information regarding the various actions of the drug, but also to determine whether trials in man are warranted. 3. The crucial test of a drug is carefully controlled clinical experimentation. Often after a drug has shown promise of considerable merit, it has been introduced through the wrong channels. Many a substance has suffered because the promoters have announced the discovery and discussed the therapeutic use through the daily press rather than presenting the claims, supported by scientific data, through proper scientific mediums which have a clientele capable of judging therapeutic evidence. The selection of a proper name is important. The name should be indicative of the chemical composition. The medical profession justly looks with suspicion on a product which has a therapeutically indicative name. When the generic chemical name is too involved for practical usage, a coined contraction is quite in order; as an example, barbital for diethylbarbituric acid. Progressive salesmen of drugs find it to their advantage to make conservative claims for a new drug; most of them present their new additions to materia medica to the official body appointed by organized medicine to inspect the competence of the evidence and to pass on the status of new and nonofficial remedies. Finally, the clinician, who is not primarily a laboratory investigator, may again be reminded that it is not safe to use a drug until it has been found acceptable by the Council on Pharmacy and Chemistry. Acceptance insures a careful inspection of the chemistry, pharmacology, clinical evidence and method of marketing of the preparation. It is not safe to use in the human body a preparation of unknown composition, of unknown potency or of doubtful dosage or a preparation the claims for which have not been established by scientific unbiased evidence.—Paul Nicholas Leech and W. P. Puckner in *J.A.M.A.*, 93:1627 (Nov. 23) 1929.

BUREAU OF PUBLIC RELATIONS

LOSS OF TEETH THROUGH IMPROPER HOME CARE OF THE MOUTH

By H. VAN DER MOLEN, Amsterdam, The Netherlands

The brush is of more importance than all else in the cleaning of the mouth—G. V. Black.[1]

IT is a generally known fact that inflammation of the peridental membrane caused by the presence of a dead dental pulp results in atrophy of the surrounding alveolar bone. (Fig. 1.) Since roentgenographic examination became popular in dental practice, we see this periapical destruction almost every day. In most cases, removal of the dead pulp and sterilization and filling of the root canal under aseptic conditions are sufficient to arrest atrophy and bring about rebuilding of the alveolar bone. (Fig. 2.) As the abovementioned facts are widely known, there would be no excuse for repeating them here were it not for an analogous process as yet not generally recognized as such and which is well worth our attention, i. e., atrophy of the alveolar margin. When roentgenographically examined in private practice, almost every adult over 25 years old, shows one or more places where the bone of the alveolar margin has been partially absorbed.

This atrophy, starting from the very margins of the alveolar process, is so frequent indeed that one feels inclined to regard it as a physiologic rather than a pathologic process. Nevertheless, it is as pathologic as the atrophy of bone which surrounds the apex.

Formerly, the search for possible causes of periapical destruction led to formulation of many different theories, but at last it became evident that its cause was an inflammation of the peridental membrane proceeding from a dead dental pulp. At present, in much the same way, a great diversity of possible causes for atrophy of the alveolar margin are suggested, while the real cause is near at hand, being an inflammation proceeding from infected gingival margins.

Superficially, it seems only logical to expect that search for the source of the latter cases of atrophy should be more advanced than that for the cause of periapical destruction, the gingival margin being much more accessible than the apex of the root. But the gingival margin is accessible not only to the dentist, but to the patient too; which is a disadvantage, as will be shown later.

Prevention of periapical destruction consists in prevention of infection via the root canal. Likewise, prevention of atrophy of the alveolar margin should consist in prevention of infection via the gingival margin, if we are to prove the analogy. We should avoid all injury of the gingival margin, bacterial damage as well as mechanical and chemical damage. With regard to the first, we should not make the error of attempting to disinfect the mouth.

1. Black, G. V.: Special Dental Pathology. Chicago: Medical Book Co., 1920, p. 427.

Normal tissue is quite effectively equipped to defend itself against bacteria, and whatever we may undertake in the way of disinfection will always result in an undesirable chemical change. In this respect, there is a great difference between living tissue and objects which come in contact with it. The common toothbrush, for instance, cannot defend itself against bacteria. It constitutes an ideal incubator for them, thus becoming a medium for bacterial injury.

How can we ever hope to prevent atrophy of the alveolar margin if we urge cleaning of the teeth without telling the public exactly how the cleaning has to be done in order not to injure the gingival

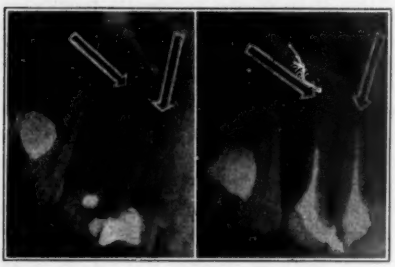


Fig. 1.—Left: Periapical bone destruction, with areas of destruction around apices of teeth containing dead pulps. Right: Case two years after root canals have been sterilized and filled. The atrophy of bone has not only stopped, but there is also rebuilding of bone.

margins; if we allow the use of tooth pastes and powders which cause chemical damages, or if we do not furnish a better cleaning instrument than the ordinary toothbrush, which in itself is a menace to the mouth?

The only way out of our present difficulties is:

1. To teach the children (and adults) how to so handle the brushes as to avoid mechanical injury. The best method hitherto recommended is shown in Figures 3-6.

(Each movement is repeated as often as necessary to clean the surfaces thoroughly. After the cleaning of each section, the mouth should be rinsed carefully, while, in the meantime, the brush is washed in a tumbler by rubbing it against the inside, so that all impurities are removed. Then fresh water is taken for the cleaning of the other section. The occlusal surfaces can be brushed in any direction, because here there is no danger of injuring the gingivae. The teeth should be cleaned carefully and the gingival margins likewise massaged, but care must be taken not to injure in the least the teeth or gingivae. The illustrations show only the position of the brush in cleaning the front teeth. The brushing of molars

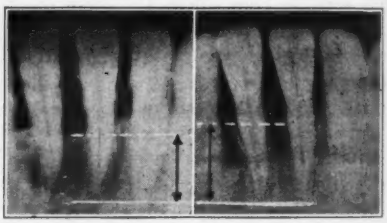


Fig. 2.—Left: Marginal bone destruction: loosening of teeth caused by infection via gum margins. Right: Case eight months later. The teeth had been cleaned and the patient had been taught how to use a toothbrush. The gums healed and the teeth are quite firm, having regained their original position without any further interference.

and bicuspids follows the same principle.)

2. To warn against the use of all chemicals generally employed in cleaning or disinfection of the mouth, as it has been experimentally proved that the ingredients in tooth pastes and powders injure either the gingivae or the enamel, or both. It is generally believed impossible to clean the teeth efficiently without the use of tooth pastes, but it can easily be proved by experiment that the reverse is

true and that materia alba is far better removed by the use of an elastic brush and plenty of plain water than with tooth paste.

The eating of fruit (if not used in excess) helps to clean the teeth and strengthen the gums. The material secreted by inflamed gums is easily removed by the use of diluted fruit juice. If patients have some difficulty in cleaning the teeth with plain water because the gums

Fig. 3.—Brushing upper teeth, outside. With the bristles pointing upward, the handle is turned around its long axis with a twisting motion of the wrist so that the bristles sweep gently over the gum margins and along the outer surface of the teeth.

Fig. 4.—Brushing lower teeth, outside. With the bristles pointing downward, the handle is turned as indicated in Figure 3 in the opposite direction.

are inflamed by the use of tooth paste and infected toothbrushes, we can help them greatly by prescribing diluted fruit juice.

3. To give the public a better instrument than the filth carrier hitherto used. It has been recommended that the toothbrush be boiled after use or kept in a solution of some disinfectant, etc.; but those methods are inefficient, either because they are too complicated, or because the brush loses its elasticity in the treatment. Besides, children cannot be trusted with antiseptics. We want a brush which disinfects itself automatically from within and which needs no special care. With this in in mind, I ordered a brush with a handle filled with trioxymethylene and the bristles planted in this slowly soluble anti-

Fig. 5.—Brushing upper teeth, inner side. The procedure is as in Figure 3, but the brush is placed on the inner side of the the teeth. The handle is turned so that the bristles sweep along the inner side of the teeth.

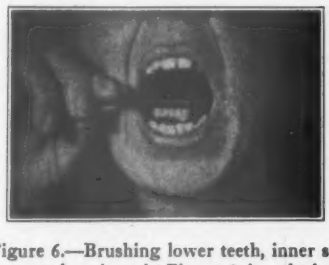


Figure 6.—Brushing lower teeth, inner side. The procedure is as in Figure 4, but the brush is placed on the inner side of the teeth.

septic. As it takes more than five minutes after the moistening of the brush before this disinfectant reaches the bristles, it cannot reach the mouth while the brush is in use. Disinfection takes place after that, and because formaldehyde evaporates easily, there is no trace of it left on the bristles when completely dried. The

contents of the handle are sufficient for half a year's daily use at least; which makes the brush of great practical value.

I am not offering a mere theory. I have employed this methodical mouth care for eleven years now, and I know what I am talking about. All my patients who have used the aseptic brush in the right way for at the last three years have healthy gingivae. Many teeth formerly loose are now quite firm again. Roentgenograms show clearly that, without exception, cases of atrophy have made no progress and that, in many of these cases, there is a rebuilding of bone at the margins of the alveolar process.

Since 1920, I have made a habit of recording every particular about the mouths of my patients, using, for instance, the numbers from 1 to 10 to indicate the formation of calculus on the teeth. Examinations were made at regular intervals. These records show that, with patients who formerly had heavy deposits of calculus when they used tooth pastes and infected toothbrushes, the formation of tartar has now completely stopped. Not one of those patients (who were surprised at first to learn that they had to discard their toothpastes) would now like to use them again. For, as the gingivae are now in a healthy condition, they always have a clean mouth, even in the early morning.

It is the unsavory taste in the mouth on rising in the morning that makes one crave something refreshing. Tooth paste gives momentary relief, but does not improve the condition of the mouth. On the contrary, the result is that more and stronger chemicals are desired.

The only way to break this vicious circle is to abandon all chemicals, to use an aseptic brush and diluted fruit juice or plain water and thereby give the gingivae a chance to heal spontaneously.

In this respect, it is noteworthy that young children, whose taste has not yet been spoiled, are happy when they learn that the use of tooth paste is no longer required.

That they easily understand the principles of mouth hygiene as taught by us by means of motion pictures and lectures in the school was shown recently when they were asked to draw free-hand posters on the subject. We received a large number of drawings from children between 8 and 16 years old and there was not one among them but showed a perfect understanding. The excellent results of our drawing competition certainly did not confirm the pessimistic opinion of some of our colleagues that our method, however true and efficient, would prove far too complicated for children to learn. Moreover, we were greatly surprised to see that, without exception, the children are deeply interested in the problem.

Sixteen years ago, G. V. Black wrote:

> This idea has become so fixed in the minds of our people, as a result of advertising propaganda by manufacturers and the belief of many dentists that these preparation are beneficial, that it is not to be expected that the public or the members of the profession will quickly change their attitude, but in the light of our present knowledge, there should be a gradual change to a more rational view.[2]

2. Footnote 1, p. 437.

TEETH VS. BEHAVIOR

By FRANK L. BEALS, Chicago, Ill.

MUCH space and printer's ink have been devoted to dental defects and their effects on the general health, but it has remained for the officials of the Chicago Board of Education to make a study of the effects of bad teeth on conduct. The reason for the study was that so many children who are truant or delinquent have carious teeth, dental infections or diseases of the oral cavity. In a general survey of all school children in Chicago, it was found that 76 per cent suffered from some sort of pathologic oral condition. A check of the special schools devoted to the welfare of problem children reveals, in one type of school, that 96 per cent of those sent there are suffering from trouble with the teeth. In another type of school, 100 per cent are affected.

"That disease conditions of the teeth often cause malfunction of other organs of the body and disturb mental and nervous equilibrium has, we believe, been established through this study," said William H. Johnson, Chicago's superintendent of schools, in commenting on the relationship between bad teeth and bad conduct. "The effect of the presence of carious or infected teeth is not well known, but it should receive careful consideration because much misbehavior in school can be traced to this source."

At the Moseley Special School, a study covering all cases of carious teeth was made. The records of the cases before and after treatment were studied and some interesting results were observed. Of thirty-eight cases studied, it was revealed that twenty of the boys concerned showed positive improvement in conduct after they had been given dental treatment. It is interesting that seven of the boys treated indicated a change for the worse; but it cannot be shown that the dental treatments were in any way responsible for this retrogression. There were eleven cases in which no change was noted. The fact that, in almost 60 per cent of the cases, a marked improvement was noted would seem to indicate that a similar experiment, carried out on a much extended scale, would be likely to show a positive correlation between correction of dental defects and improvement in school conduct.

A study similar to that of the Moseley School just cited was made at the Montefiore Special School. The principal reports that the preponderance of evidence is that when there is a change of conduct after dental work, the change is for the better.

Children are committed to the Chicago Parental School by the judge of the juvenile court. Their conduct has been such that it could no longer be treated in the home school or in one of the special schools for truants, delinquents and incorrigibles. The parental school is, then, the last resort in the corrective chain. The records show that 100 per cent of the boys and girls committed have serious dental defects. Steps are taken, under the direction of the city health department, to make the necessary corrections. The records show that after this is done, there is a marked improvement in conduct. The fact that 60 per cent of those paroled make good indicates definitely

that there is an improvement in conduct. The experiment has not progressed far enough as yet to enable the authorities to determine just how much of the bad conduct is due to the presence of poor teeth and how much is due to other conditions.

A few typical cases may be cited to show the effect of correction of defective teeth:

1. Before, the boy was mean and disagreeable, fighting with other children, and impudent to the teacher, resentful when corrected.

After, when corrected, he smiled instead of scowling. He gets along better with his classmates and is becoming a better pupil.

(After observing the improvement, his mother promises to take him to a clinic to have other physical defects corrected.)

2. Before, the boy was an habitual truant.

After, he did not miss more than one day from school. This is the best record he has had since he entered the public schools.

3. Before, the boy suffered from constant toothache and had a disagreeable disposition.

After, there was a great improvement in disposition.

4. Before, the boy was indifferent and did poor work.

After, he became ambitious, and wishes to do good work.

5. Before, the boy was noisy, obstreperous and difficult to handle.

After, he was quieter, improved in conduct and tractable.

6. Before, the child was indifferent to studies, and discouraged.

After, he was eager to work. He says, "My mouth feels nice and clean."

7. Before, the boy's conduct was bad and he would not participate in class activities.

After, his conduct improved and he likes to sing in the Glee Club since his teeth do not hurt.

8. Before, the boy was restless and could not sit still, and left his work uncompleted.

After, he became quiet and attentive and completed assigned tasks.

It is believed that the findings in the cases studied are so significant that the study will be extended.

When Your Teeth Decay

A new mechanical exhibit developed by the Bureau of Public Relations is especially designed for public health meetings.

New mechanical exhibit prepared for use of dental societies and health organizations.

An electrically driven, endless belt passing behind a large transparent longitudinal section of a tooth portrays the progress of decay from its initial attack on the enamel until it culminates in an abscess at the root end. As the decay advances, its progress is explained by means of shadow boxes placed at the side of the tooth. An illuminated shadow box near the base shows some of the organs that may become injured because of dental infection.

The exhibit is 40 inches high, 32 inches wide and 20 inches deep. Placed upon its shipping case, which may be used as a base, it is 6 feet over all. It is prepared for the use of state and component societies.

Rental: $3 a week, plus shipping charges

to and from Chicago. Address the Bureau of Public Relations, American Dental Association, 212 E. Superior Street, Chicago, Ill.

Chicago Dental Society Round Table Radio Talks

The Chicago Dental Society, encouraged by the results obtained through the broadcasts which they have been sponsoring, known as the Question Box program and an interview and conversation program, have launched a unique feature on the air on Saturdays (commencing January 9) at 2 p. m., over Station WJJD, which should be both educational and enlightening to the laity.

This series of broadcasts will be made in cooperation with the Chicago College of Dental Surgery of Loyola University, University of Illinois College of Dentistry and the Northwestern University Dental School. It will be in the form of a round table discussion on subjects of dentistry of general interest to the laity, given to them in an interesting manner and interwoven with songs by the Chicago Dental Society Glee Club.

The Chicago Dental Society broadcast will be represented by its officers and the groups representing the colleges will be selected from the faculty of the particular school broadcasting. There will be a round table broadcast every week, each group giving one broadcast a month. It is hoped that this program can be perpetuated if enough interest is shown in this type of education.

Irving E. Laby, *Chairman,*
Radio Broadcasts.

A.D.A. Now Broadcasting Over Columbia Midwest Network

The American Dental Association's fifteen minute radio program presented weekly since last September over Columbia's northwest chain has recently been transferred to Columbia's larger midwest network. The programs are now available to twenty stations and reach a potential audience in ten states.

The Columbia Broadcasting System furnishes the time and facilities free of charge to the American Dental Association.

The talks are released as a sustaining educational feature and are available to all stations on Columbia's midwest network that desire to use them.

If you live in the territory covered by any of the stations listed below, request the station manager to take advantage of these programs.

The American Dental Association is indebted to the Columbia Broadcasting System for their generous cooperation in making these dental educational talks available.

STATIONS ON COLUMBIA MIDWEST NETWORK

WISN	Milwaukee	KFH	Wichita
WMBD	Peoria	KTUL	Tulsa
WOC	Davenport	KMOA	Oklahoma City
KRNT	Des Moines	KGKO	Wichita Falls
WCCO	Minneapolis	KWKH	Shreveport
KSCJ	Sioux City	KRLD	Dallas
WNAX	Yankton	WACO	Waco
KFAB	Lincoln	KNOW	Austin
KMBC	Kansas City	KTSA	San Antonio
WIBW	Topeka	KTRH	Houston

DENTAL ECONOMICS

IOWA SUPREME COURT DECISION

IN the Supreme Court of Iowa *in re* J. G. Craven *vs.* Walter L. Bierring, Commissioner of Public Health *et al.*, in May, 1935, the legislature enacted certain amendments to the law placing more stringent limitations on advertising by those engaged in the practice of dentistry.

The law provided that, as to dentists, unprofessional conduct shall consist of any of the acts denominated as such elsewhere in the law and also all advertising of any kind or character other than the carrying or publishing of a professional card displaying only the name, address, profession, office hours and telephone connections.

The law also provided for the expiration of every dental license on the thirtieth day of June following date of issuance and that application for renewal shall be accompanied by an affidavit of the applicant stating in substance that he has not violated any of the provisions of the general practice act or committed any of the acts of unprofessional conduct as defined in the title.

It was further provided that if, prior to the renewal of any license, the commissioner is informed upon oath or affirmation that any applicant has during the last renewal of his license violated any of the provisions of the law, or if it is certified in writing to the Department of Health by the State Board of Dental Examiners that such violation of law or act of unprofessional conduct has been committed by such applicant, that a hearing be held by the commissioner at which time the applicant may appear and show cause why such license should be renewed.

This provision places the burden of proof on the applicant, and not the department of health.

J. G. Craven brought suit in equity for injunction to restrain the defendants from enforcing or attempting to enforce certain provisions of the statutes relating to the profession of dentistry. From a decree for the defendants dismissing the plaintiff's petition and rendering judgment against him he appealed.

The plaintiff contended in his suit attacking the law on constitutional grounds that, as a result of the law, he was precluded from advertising and, as a consequence, had lost substantial sums in his practice; that if forced to abide by the law, he will suffer irreparable injury and damage; that much of his valuable office equipment will be worthless; that the limitations on the scope of advertising are unreasonable, arbitrary, whimsical and capricious and have no fair or reasonable relationship to the protection of the public health; that it illegally restrains and prevents freedom of speech and is indefinite, ambiguous and uncertain in its terms; that it is an invalid exercise of the police power, and that it is class legislation, discriminatory in character.

Justice Hamilton, in a masterful opinion, said:

> Statutes regulating the practice of medicine clearly fall within the police power of the state. The practice of dentistry falls under the same rule. Police power is constantly exercised by the state, yet a definition of such power has never been definitely and precisely formulated. In fact, public policy rather demands there shall be no specific definition; each case as it arises must be determined according to its own facts.

Neither is appellant entitled to complain

on the ground of class legislation or that the act is in derogation of plaintiff's right of contract. Both of these questions were involved in Semler *vs.* Oregon and upheld by the U. S. Supreme Court on appeal.

There is but one constitutional question of sufficient merit to warrant our serious consideration; namely, whether or not the limitations upon advertising are so arbitrary and unreasonable as to constitute an unlawful restraint, infringement and interference with the plaintiff's inherent right to carry on a lawful vocation. All presumptions are in favor of its constitutionality, and a statute will not be held unconstitutional unless its controvention of constitution guaranties is so clear, plain and palpable as to leave no reasonable doubt on the subject.

The most conclusive answer to all of plaintiff's contentions is found in the opinion of Chief Justice Hughes, and while the Oregon law is not in the same language, it does strike at the same veil, and the Iowa statute takes the other way around and bars all advertising except those methods specified.

The appellant contended that, in an attempt to regulate the practice of dentistry, the legislature is destroying his right to practice. Justice Hamilton said,

The weakness of this contention is found in the undoubted fact that these laws restricting advertising have the sanction of the dental profession as a whole. *They are intended to preserve the profession, not to destroy it.* Such laws are not enacted for the benefit of any class of individuals, but in the interest of the general public. In the sense that they tend to prevent an unseemly rivalry in the race for business, and preserve a rational, reasonable and ethical approach to the public and aid the profession in maintaining its service upon a high plain of efficiency, such laws may be said to be beneficial to the profession as a whole; but this is not the primary purpose of the law. It is but one of the beneficial and beneficent fruits of the law.

The experience of mankind has shown that human greed and avarice, untrammeled and uncontrolled by law, will not hesitate to prey upon the frailties of overcredulous human beings. . . . The underlying purpose of legislation of this character is to strike at the charlatan and unscrupulous practitioner who endeavors to entice and allure an unsuspecting and credulous public by means commonly referred to as "bait" advertising and by which means they become victims of his quackery.

Obviously, no legislation can be upheld which would apply alone to the quack, but such legislation must in its general application rest alike on all members of the profession concerned . . . if legislation of this kind is necessary to reach the unscrupulous in the interest of public welfare, the adoption of such rules and regulations by the legislature does not invade or contravene the constitutional rights of the plaintiff. . . . *The best interests of the public demand that members of a profession affecting the public health stand or fall on the merits of their services, and not on their skill in advertising.*

These laws are made necessary because there are those in society who must be restrained. These laws and regulations are deemed essential because without them the opportunity to commit fraud would be left open to the unscrupulous and dishonest individuals. Such laws and rules are the outgrowth of the experiences of mankind and represent the combined judgment and wisdom of the lawmakers of all times. Regulation of unprofessional conduct deemed unduly drastic ten years ago might well be considered reasonable under present-day conditions.

In relation to those vocations of life having to do with the health of individuals, the state, through the exercise of its police power, may enact laws regulating and restricting the professions, so long as such legislation is reasonable and appropriate to accomplish the legitimate purpose of safeguarding of the public health. It was for the legislature to say whether or not it was necessary, in order to close the door against the unscrupulous practitioner, against perpetration of fraud and deception upon his patients, that all advertising except as

designated by statute be prohibited, and this is the real pith of the controversy in this case. There is no claim that in itself there is anything harmful in advertising prices for dental work, but we think it must be admitted that there are some dishonest and disreputable members of the profession who are willing to abide by what is commonly called the ethics of the profession, and who make use of such methods of advertising, and the unsuspecting public and over-credulous members of society, unable to distinguish the true from the false, or the honest from the dishonest, are lured to the office or lairs of the professional charlatans, who point to their array of expensive office equipment and over-stuffed furnishings to convince their unsuspecting patients of their superiority, and use this as an excuse for "fleecing" them.

Finally, and in the last analysis, when the legislature speaks through a valid exercise of the police power, it is the voice of the people speaking in defense or preservation of its own well-being, and while, under the Iowa Statutes, the limitations on advertising are rigid, they are not too rigid when the purpose or aim of the law is considered.

Judgment was affirmed.

DENTAL HEALTH EDUCATION ACTIVITIES IN GEORGIA

TO interpret the activities of the Department of Health Education of the Georgia State Department of Public Health, it is necessary to understand the organization and plan of the program, which is as follows:

The program of dental health education is supervised by an educator, who confines her activities to education and organization.

Because the program has become a cooperative endeavor of the state department of health, the Georgia Dental Association and the state department of education, the scope of the program has broadened to include inspection, correction and training, with each group doing the work for which it is best prepared.

Inspection is made by local dentists visiting the schools on invitation and through arrangements made by school superintendents.

Correction is made by local dentists as children are notified and encouraged by the school to have defects corrected. The local dentists cooperate with the school and parent-teacher association in providing for indigents. The increase in number of pay patients following the educational program of schools enables the local dentists to aid in the care of indigents.

Education and training are carried on by the school, the teacher seeking authentic information from the local dentist, state board of health and other organizations, and interpreting it to the child in terms of child learning.

The program revolves around the state department of health. The department of education, with its affiliated groups, is the medium through which information is disseminated, and the school furnishes the organized field for work. The dental profession offers free dental inspection to all preschool and school children and 4-H Club members.

The Georgia Dental Association furnishes an active organization made up of a state chairman, sixteen district chairmen and one hundred and fifty-nine county chairmen, who cooperate with the state department of health and also with local school superintendents and county health departments in organizing county programs of inspection and correction to fit local problems and facilities available.

The division of dental health education furnishes printed material for dental inspection, educational bulletins for teachers and material for adult education. Reports are sent to the department of health for tabulation.

The major part of the work of the department of dental health education centers around the following groups:

1. State department of health: department of dental health education
   (*a*) County health officers
   (*b*) Nurses
2. Georgia Dental Association
   (*a*) State chairman of health education
   (*b*) District and county chairmen
   (*c*) All ethical dentists in Georgia
3. State department of education
   (*a*) Administrative staff and supervisors
   (*b*) County and city superintendents
4. Georgia Congress of Parents and Teachers
   (*a*) Board of managers
   (*b*) Local parent-teacher associations
5. Agriculture extension service
   (*a*) Administrators
   (*b*) Home demonstration agents
   (*c*) 4-H Club boys and girls

STATE DEPARTMENT OF HEALTH: DEPARTMENT OF DENTAL HEALTH EDUCATION

In every county in which there is an organized county health department, the dental health education program is related to the work of that department, the health officer and nurses always being asked to attend conferences and assist in the organization. The nurses, under the supervision of the state and county health departments, assist by prenatal and preschool work and by visits to the homes to encourage follow-up.

GEORGIA DENTAL ASSOCIATION

The state chairman, who is elected by the executive council for a term of three years, is the vital force in leading the dental profession to support the program. Through state, district and county chairmen, we have an organization of 177 dentists, who have as their special duty the promotion of dental health education. Through this organization, all ethical dentists are brought within the scope of the plan. Throughout the state, members and nonmembers are giving free dental inspection and assisting in organizing corrective programs.

STATE DEPARTMENT OF EDUCATION

The state school superintendent appreciates the value of dental health as a means of improving the health and efficiency of school children and therefore requires his entire staff of supervisors to promote the program of the state department of health. He sends letters to all superintendents, urging cooperation and giving the name of the county dental chairman with whom each should confer. Teachers are reached through the colleges and teacher study groups. The supervisor is cooperating with the state department of education in a curriculum revision program. Schools are visited and educational talks are given to children.

GEORGIA CONGRESS OF PARENTS AND TEACHERS

Dental Health Education is accepted as one of the projects of the state and local parent-teacher associations, beginning with preschool conferences. Last year, the Georgia congress received the national award for the greatest number of dental corrections after school dental inspection.

AGRICULTURAL EXTENSION SERVICE

Through the aid of the extension nutritionist of the agricultural service, a project "Build and Protect Your Teeth" is being presented to 4-H Club boys and girls. Home demonstration and farm agents assist in this organization.

To date, 5,600 letters have been sent out in the organization of the program this year from the state department of health, to all dentists in Georgia, county chairmen, district chairmen, all school superintendents, parent-teacher association presidents and home-demonstration agents. From Dr. Williams, health education chairman of the Georgia Dental Association, letters have been sent to all dentists in Georgia, county chairmen, district chairmen; from the president of the Georgia Congress of Parents and Teachers, to all parent-teacher association presidents, and from the department of education, to all school superintendents and district and county chairmen.

One hundred seven counties have completed or partially completed the dental inspection.

One hundred thirty-five dentists in Fulton County inspected 16,000 Fulton County children October 14. The same dentists inspected 15,000 school children in three adjoining counties October 28. The Fulton County school superintendent and principals are reporting that large percentages of children have already returned dental certificates.

Practically every county is promoting some definite program for dental corrections.

Final tabulation of reports will not be made until May 1, 1937. Letters received from superintendents and dentists from all parts of the state indicate satisfactory corrective programs.

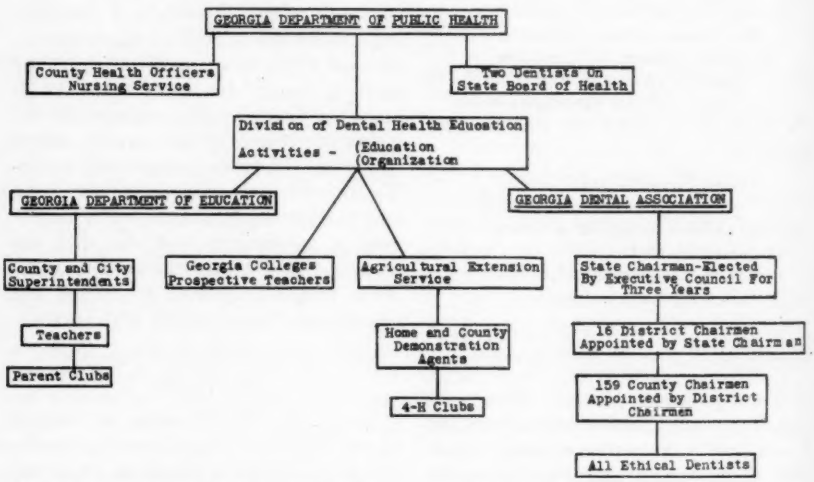
Teachers are emphasizing the threefold purpose of the dental health education program: diet, cleanliness and dental care.

Whereas there formerly were many programs promoted by different organizations throughout the state, all organizations existing for child health and welfare now cooperate with the uniform program of the state department of health.

ORGANIZATION PLAN

FOR

DENTAL HEALTH EDUCATION IN GEORGIA


GEORGIA DEPARTMENT OF PUBLIC HEALTH
County Health Officers Nursing Service
Two Dentists On State Board of Health
Division of Dental Health Education
Activities - (Education (Organization
GEORGIA DEPARTMENT OF EDUCATION
GEORGIA DENTAL ASSOCIATION
County and City Superintendents
Georgia Colleges Prospective Teachers
Agricultural Extension Service
State Chairman-Elected By Executive Council For Three Years
Teachers
Parent Clubs
Home and County Demonstration Agents
16 District Chairmen Appointed by State Chairman
4-H Clubs
159 County Chairmen Appointed by District Chairmen
All Ethical Dentists

NATIONAL INCOME IN THE UNITED STATES

A monograph recently prepared by the Division of Economic Research, U. S. Department of Commerce, contains in tabular form statistics which are of interest to all dentists. Three tables are presented herewith:

TABLE 184.—NUMBER OF PERSONS ENGAGED IN CURATIVE PROFESSIONAL SERVICE, PRIVATE PRACTICE

Line	Item	1929	1930	1931	1932	1933	1934
1.	Total number engaged	540,336	551,696	552,799	545,950	554,478	569,149
2.	Total number of employes	169,945	172,447	164,463	148,930	147,499	152,707
3.	Physicians' and surgeons' employes	117,685	119,266	113,480	102,501	101,575	105,230
4.	Dentists' employes	52,260	53,181	50,983	46,429	45,924	47,477
5.	Total number of entrepreneurs	370,391	379,249	388,336	397,020	406,979	416,442
6.	Physicians and surgeons	119,324	120,865	122,404	123,689	124,969	126,253
7.	Dentists	57,218	58,195	59,382	60,500	62,771	63,452
8.	Other professions	38,849	38,448	38,068	37,608	37,275	37,408
9.	Trained nurses on private duty	142,000	149,365	156,730	164,095	171,460	178,825
10.	Other semiprofessional service, curative	13,000	12,376	11,752	11,128	10,504	10,504
		Percentages of 1929					
1.	Total number engaged	100.0	102.1	102.3	101.0	102.6	105.3
2.	Total number of employes	100.0	101.5	96.8	87.6	86.8	89.9
3.	Physicians' and surgeons' employes	100.0	101.3	96.4	87.1	86.3	89.4
4.	Dentists' employes	100.0	101.8	97.6	88.8	87.9	90.8
5.	Total number of entrepreneurs	100.0	102.4	104.8	107.2	109.9	112.4
6.	Physicians and surgeons	100.0	101.3	102.6	103.7	104.7	105.8
7.	Dentists	100.0	101.7	103.8	105.7	109.7	110.9
8.	Other professions	100.0	99.0	98.0	96.8	95.9	96.3
9.	Trained nurses on private duty	100.0	105.2	110.4	115.6	120.7	125.9
10.	Other semiprofessional service, curative	100.0	95.2	90.4	85.6	80.8	80.8

TABLE 185.—INCOME PAID OUT AND PRODUCED IN CURATIVE PROFESSIONAL SERVICE, PRIVATE PRACTICE
(IN THOUSANDS OF DOLLARS)

Line	Item	1929	1930	1931	1932	1933	1934
1.	Income paid out	1,394,826	1,355,468	1,194,893	923,882	866,881	991,325
2.	Compensation of employes	172,957	175,503	164,092	137,917	129,583	135,532
3.	Physicians' and surgeons' employes	120,156	121,771	113,593	95,223	91,214	95,654
4.	Dentists' employes	52,801	53,732	50,498	42,693	38,369	39,878
5.	Net income of entrepreneurs	1,221,869	1,179,965	1,030,801	785,965	737,298	855,793
6.	Physicians and surgeons	644,708	618,708	536,497	410,647	385,904	450,723
7.	Dentists	261,143	254,312	224,761	168,492	156,990	176,841
8.	Other professions	129,618	122,199	104,301	77,657	71,035	81,479
9.	Trained nurses on private duty	170,400	170,276	153,439	120,774	116,078	138,411
10.	Other semiprofessional service (curative)	16,000	14,470	11,803	8,395	7,291	8,339

		Percentages of 1929					
1.	Income paid out	100.0	97.2	85.7	66.2	62.1	71.1
2.	Compensation of employes	100.0	101.5	94.9	79.7	74.9	78.4
3.	Physicians' and surgeons' employes	100.0	101.3	94.5	79.2	75.9	79.6
4.	Dentists' employes	100.0	101.8	95.6	80.9	72.7	75.5
5.	Net income of entrepreneurs	100.0	96.6	84.4	64.3	60.3	70.0
6.	Physicians and surgeons	100.0	96.0	83.2	63.7	59.9	69.9
7.	Dentists	100.0	97.4	86.1	64.5	60.1	67.7
8.	Other professions	100.0	94.3	80.5	59.9	54.8	62.9
9.	Trained nurses on private duty	100.0	99.9	90.0	70.9	68.1	81.2
10.	Other semiprofessional service (curative)	100.0	90.4	73.8	52.5	45.6	52.1

TABLE 186.—PER CAPITA INCOME WITHDRAWN IN CURATIVE PROFESSIONAL SERVICE, PRIVATE PRACTICE

Line	Item	1929	1930	1931	1932	1933	1934
1.	Total engaged	$2,581	$2,457	$2,162	$1,692	$1,564	$1,742
2.	Total employes	1,018	1,018	1,003	926	879	888
3.	Physicians' and surgeons' employes	1,021	1,021	1,001	929	898	909
4.	Dentists' employes	1,010	1,010	990	920	835	840
5.	Total entrepreneurs	3,299	3,111	2,654	1,980	1,812	2,055
6.	Physicians and surgeons	5,403	5,119	4,383	3,320	3,088	3,570
7.	Dentists	4,564	4,370	3,785	2,785	2,501	2,787
8.	Other professions	3,336	3,178	2,740	2,065	1,906	2,178
9.	Trained nurses on private duty	1,200	1,140	979	736	677	774
10.	Other semiprofessional service (curative)	1,231	1,169	1,004	754	694	794
		Percentages of 1929					
1.	Total engaged	100.0	95.2	83.8	65.6	60.0	67.5
2.	Total employes	100.0	100.0	98.0	91.0	86.3	87.2
3.	Physicians' and surgeons' employes	100.0	100.0	98.0	91.0	88.0	89.0
4.	Dentists' employes	100.0	100.0	98.0	91.0	82.7	83.2
5.	Total entrepreneurs	100.0	94.3	80.4	60.0	54.9	62.3
6.	Physicians and surgeons	100.0	94.7	81.1	61.4	57.2	66.1
7.	Dentists	100.0	95.7	82.9	61.0	54.8	61.1
8.	Other professions	100.0	95.3	82.1	61.9	57.1	65.3
9.	Trained nurses on private duty	100.0	95.0	81.6	61.3	56.4	64.5
10.	Other semiprofessional service (curative)	100.0	95.0	81.6	61.3	56.4	64.5
11.	Bureau of Labor Statistics cost-of-living index	100.0	97.7	89.1	80.5	76.2	78.9

Wisconsin State Dental Division

One of the hopes of the officers and members of the Wisconsin State Dental Society was realized when the position of supervisor of dental education was created in the state department of health.

F. A. Bull, Milwaukee, was appointed to the position after a civil service examination in which more than forty applicants participated. He assumed his new duties December 1.

Dr. Bull brings to this position a background of training and experience that peculiarly fit him for health work. He has been very active in state society affairs for a number of years, has headed many of its important committees and is at present the chairman of the state society committee on dental education.

St. Louis Public School Health Education

Dec. 9, 1936, the St. Louis (Mo.) Board of Education created a new department known as the department of health education. Ewing P. Brady, who for the past thirty-three years has been connected with Washington School of Dentistry, has been appointed supervisor. Dr. Brady is especially well qualified for his new position. He began teaching in 1904, and, not being content with limiting his knowledge to dentistry alone, he, early in his career, studied both medicine and engineering. His years of experience as teacher, research worker and executive, plus his interest in the problems of preventive dentistry, presage a new era of oral health for St. Louis school children.

Tennessee State Dental Division

Nov. 1, 1936, P. E. Blackerby, Jr., was appointed director of Tennessee's new state dental hygiene division. Dr. Sebelius, the other member of the dental staff, was appointed in September. As the work of the new division is just getting started, it is too early to announce their plans.

Boy Scout Health Committee

Dec. 5, 1936, E. H. Bruening was appointed a member of the Health and Safety Committee of the Boy Scouts of America. Dr. Bruening has been interested in Boy Scout work for a number of years and this new appointment to the national committee will bring about a closer alliance between the American Dental Association and the Boy Scouts of America.

Financing a Service Bureau

A sum of $300 a month will be available to the Medical-Dental Service Bureau, St. Louis, under a resolution adopted by the three societies, participating in the plan: the St. Louis County Medical Society, St. Louis Dental Society and St. Louis Medical Society. The money will be appropriated from a general fund when and if needed for a period of three months, but not to exceed $900.

Be it resolved:

1. In order to further extend the very comprehensive services of the Medical-Dental Service Bureau in accomplishing its objective of providing good medical, dental and hospital care to the people of this community, and in order to make available to them such care in a manner that is compatible with their ability to pay; and further

2. To act in concert with the St. Louis Dental Society in making possible the continuance of the Bureau's activities, that the St. Louis Medical Society advance, additionally and finally, out of general funds available, $300 monthly when and if needed for a period of three months but not to exceed $900.

The St. Louis bureau is patterned after the so-called Washington Plan. It is managed by a board of directors made up of representatives of the three participating societies.—*J.A.M.A.*, Jan. 9, 1937.

DIRECTORY OF STATE SOCIETY OFFICERS AND DATES OF MEETINGS, 1936-1937

ALABAMA

F. A. Webb, Jr., President.....Van Antwerp Bldg., Mobile
Harry Bradford, President Elect.....Medical Arts Bldg., Birmingham
Hunter S. Allen, Secretary.....First Nat'l Bank Bldg., Birmingham
J. Sharpe Gillespy, Treasurer.....First Nat'l Bank Bldg., Birmingham
Place of next meeting: Mobile.
Date of next meeting: April 12-14, 1937.

ARIZONA

Paul H. Bennett, President.....908 Valley Nat'l Bldg., Tucson
K. E. Stenjnger, President Elect.....Hayden
Paul K. Hill, Secretary-Treasurer.....801 Valley Nat'l Bldg., Tucson
Place of next meeting: Phoenix, Ariz.
Date of next meeting:

ARKANSAS

S. P. Rushing, President.....El Dorado
M. D. Gibbs, President Elect.....Hot Springs
I. M. Sternberg, Secretary-Treasurer.....Fort Smith
Place of next meeting: Little Rock.
Date of next meeting: May 10-12, 1937.

CALIFORNIA

Sanford M. Moose, President.....450 Sutter St., San Francisco
Henry C. Petray, President Elect.....1904 Franklin St., Oakland
Frederick T. West, Secretary.....2180 Washington St., San Francisco
John W. Leggett, Treasurer.....490 Post St., San Francisco
Place of next meeting: San Jose.
Date of next meeting: April 12-14, 1937.

SOUTHERN CALIFORNIA

Cecil S. Dickinson, President.....911 Bay Cities Bldg., Santa Monica
J. C. A. Harding, President Elect.....First Nat'l Bank Bldg., San Diego
Stanley Rice, Secretary.....1048 Roosevelt Bldg., Los Angeles
Earl J. Thee, Treasurer.....3780 Wilshire Blvd., Los Angeles
Place of next meeting: Los Angeles.
Date of next meeting: Sept. 13-15, 1937.

COLORADO

Bertram H. Downs, President...609 Exchange Nat'l Bank Bldg., Colorado Springs
T. J. Rogers, Vice President.....Republic Bldg., Denver
Oliver H. Devitt, Secretary.....523 Republic Bldg., Denver
E. C. Carter, Treasurer.....962 Metropolitan Bldg., Denver
Place of next meeting: Colorado Springs.
Date of next meeting: June 10-12, 1937.

CONNECTICUT

J. A. Bray, President.....99 Pratt St., Hartford
A. B. Rosoff, President Elect.....265 Church St., New Haven
C. W. Vivian, Secretary-Treasurer.....58 Elbridge Rd., New Britain
Place of next meeting: Hartford.
Date of next meeting: May 5-7, 1937.

DELAWARE

W. Ralph Staats, President.....Medical Arts Bldg., Wilmington
C. R. Cannon, Vice President.....Georgetown
Richard R. Wier, Secretary.....1117 Adams St., Wilmington
P. A. Traynor, Treasurer.....805 Washington St., Wilmington
Place of next meeting:
Date of next meeting:

DISTRICT OF COLUMBIA

G. Albert Smith, President.....1835 Eye St., N. W., Washington
John P. Burke, President Elect.....Colorado Bldg., Washington
Daniel F. Lynch, Secretary-Treasurer.....1149 16th St., N. W., Washington
Place of next meeting: Washington.
Date of next meeting: March 7-10, 1937.

FLORIDA

P. C. Harrell, President.....Clinic Bldg., Orlando
R. D. Cummins, President Elect.....West Coast Title Bldg., St. Petersburg
Lloyd N. Harlow, Secretary-Treasurer.....Bradenton
Place of next meeting: Hollywood.
Date of next meeting: Nov. 4-6, 1937.

GEORGIA

W. Kingman White, President.....12 Jones St. East., Savannah
Paul McGee, President Elect.....Waycross
Carl Betts, Vice President.....Rome
R. H. Murphy, Secretary.....920 Georgia Casualty Bldg., Macon
H. J. Choate, Treasurer.....Cartersville
Place of next meeting: Savannah.
Date of next meeting: May 17-19, 1937.

HAWAII

M. I. Connor, President.....Palama Settlement, Honolulu
J. K. Kahaleanu, President Elect.....1136 Punchbowl St., Honolulu
John Dawe, Secretary.....Palama Settlement, Honolulu
R. Ipponsugi, Treasurer.....River and Beretania Sts., Honolulu
Place of next meeting: Honolulu.
Date of next meeting: December, 1937.

IDAHO

E. F. Seibert, President.....Boise
R. C. Peterson, President Elect.....Lewiston
H. B. Colver, Secretary.....Boise
P. G. Flack, Treasurer.....Boise
Place of next meeting: Boise.
Date of next meeting: June, 1937.

ILLINOIS

William A. McKee, President.....Benton
E. C. Pendleton, President Elect.....3650 Lake Shore Drive, Chicago
Ben H. Sherrard, Secretary.....300 Rock Island Bank Bldg., Rock Island
P. B. D. Idler, Treasurer.....55 E. Washington St., Chicago
Place of next meeting: Springfield.
Date of next meeting: May 11-13, 1937.

INDIANA

H. T. Berkey, President.....Wayne Pharmacal Bldg., Ft. Wayne
H. J. Longcamp, President Elect.....Aurora
A. R. Ross, Secretary.....Lafayette
William Bogie, Treasurer.....Vincennes
Place of next meeting: Indianapolis.
Date of next meeting: May 17-19, 1937.

IOWA

W. J. Charters, President.....415 Southern Surety Bldg., Des Moines
A. W. Bryan, President Elect.....Iowa City
John Scholten, Secretary.....810 Dows Bldg., Cedar Rapids
L. C. Dow, Treasurer.....Marion
Place of next meeting: Des Moines.
Date of next meeting: May 4-6, 1937.

KANSAS

Leon R. Kramer, President.....State House, Topeka
L. Wesley Lucas, President Elect.....First Nat'l Bank Bldg., Wichita
Fred A. Richmond, Secretary.....Federal Reserve Bldg., Kansas City
W. T. Triplett, Treasurer.....Salina
Place of next meeting: Kansas City, Mo. (Missouri-Kansas Meeting).
Date of next meeting: May 16-19, 1937.

KENTUCKY

E. H. Gardner, President.....Bardwell
R. P. Thomas, President Elect.....Heyburn Bldg., Louisville
J. H. Fullenwider, Secretary-Treasurer.....Heyburn Bldg., Louisville
Place of next meeting: Louisville.
Date of next meeting: April 5-7, 1937.

LOUISIANA

Malcolm E. Kaffie, President.....711 Medical Arts Bldg., Shreveport
Louis P. Laville, President Elect.....Plaquemine
Julian S. Bernhard, Secretary.....417 Medical Arts Bldg., Shreveport
Oscar J. Ory, Treasurer.....Garyville
Place of next meeting: New Orleans.
Date of next meeting: April 8-10, 1937.

MAINE

Frederick C. Lovejoy, President.....Farmington
George A. Phillips, Secretary.....31 Central St., Bangor
Darius S. Roberts, Treasurer.....655 Congress St., Portland
Place of next meeting: Rangeley.
Date of next meeting: June 25-26, 1937.

MARYLAND

A. Y. Russell, President.....2128 St. Paul St., Baltimore
C. O. Diehl, President Elect.....Hagerstown
Norval H. McDonald, Secretary.....609 Medical Arts Bldg., Baltimore
E. Leroy Knoebel, Treasurer.....612 Medical Arts Bldg., Baltimore
Place of next meeting: Baltimore.
Date of next meeting: May 3-5, 1937.

MASSACHUSETTS

Paul J. McKenna, President.....69 Chestnut St., Springfield
John J. Goodridge, President Elect.....77 Broad St., Lynn
Philip E. Adams, Secretary.....106 Marlborough St., Boston
Joseph T. Paul, Treasurer.....419 Boylston St., Boston
Place of next meeting: Boston.
Date of next meeting: April 26-30, 1937.

MICHIGAN

William F. Northrup, President.....Stroh Bldg., Detroit
U. Garfield Rickert, President Elect.....University of Michigan, Ann Arbor
William R. Davis, Secretary.....Michigan Dept. of Health, Lansing
E. J. Chamberlain, Treasurer.....Ashton Bldg., Grand Rapids
Place of next meeting: Detroit.
Date of next meeting: April 26-28, 1937.

MINNESOTA

F. Denton White, President.....512 Physicians & Surgeons Bldg., Minneapolis
E. A. Rieke, President Elect.....527 Lowry Bldg., St. Paul
L. M. Cruttenden, Secretary.....1353 Lowry Bldg., St. Paul
A. R. Schmid, Treasurer.....Worthington
Place of next meeting: Minneapolis.
Date of next meeting: February 23-25, 1937.

MISSISSIPPI

M. L. Jones, President.....Meridian
A. H. Henderson, President Elect.....Greenville
George P. Evans, Secretary-Treasurer.....Jackson
Place of next meeting: Jackson.
Date of next meeting: April 5-7, 1937.

MISSOURI

Harry A. Allshouse, Jr., President.....6333 Wyandotte, Kansas City
George T. Rielly, President Elect.....Fulton
C. W. Digges, Secretary-Treasurer.....Columbia
Place of next meeting: Kansas City, Mo.
Date of next meeting: May 16-19, 1937.

MONTANA

A. S. Chichester, President.....Great Falls
J. R. Burgess, President Elect.....Glasgow
T. T. Rider, Secretary-Treasurer.....Missoula
Place of next meeting: Anaconda.
Date of next meeting: May 6-8, 1937.

NEBRASKA

L. T. Hunt, President.....504 Security Mutual Bldg., Lincoln
F. T. Daly, Vice President.....Cambridge
F. A. Pierson, Secretary.....1112 Federal Securities Bldg., Lincoln
G. L. Spencer, Treasurer.....Sharp Bldg., Lincoln
Place of next meeting: Omaha.
Date of next meeting: May 17-19, 1937.

NEW HAMPSHIRE

H. DeWitt Cross, President.....Nashua
A. R. Fogg, President Elect.....Hanover
F. E. Williams, Secretary.....Manchester
W. A. Young, Treasurer.....Concord
Place of next meeting: North Conway.
Date of next meeting: June 21-22, 1937.

NEW JERSEY

J. Robert K. Moodey, President.....42 Park Place, Morristown
Harry L. Bull, President Elect.....921 Bergen Ave., Jersey City
F. K. Heazelton, Secretary.....223 E. Hanover St., Trenton
Walter A. Schilke, Treasurer.....46 E. Palisade Ave., Englewood
Place of next meeting: Atlantic City.
Date of next meeting: April 24, 1937.

NEVADA

L. D. Sullivan, President.....Minden
A. A. Cozzallio, President Elect.....First Nat'l Bank Bldg., Reno
H. E. Cafferata, Secretary-Treasurer.....First Nat'l Bank Bldg., Reno
Place of next meeting: Reno.
Date of next meeting: June 5, 1937.

NEW MEXICO

J. S. Eilar, President.....Albuquerque
George S. Westfall, President Elect.....Carlsbad
Fred Muller, Secretary-Treasurer.....Taos
Place of next meeting: Albuquerque.
Date of next meeting: June, 1937.

NEW YORK

D. Austin Sniffen, President.....121 Westchester Ave., White Plains
Russell W. Tench, Vice President.....745 Fifth Ave., New York City
Edwin I. Harrington, President Elect.....Watertown
Charles A. Wilkie, Secretary.....45 Fourth Ave., New York City
George H. Butler, Treasurer.....Skaneateles
Place of next meeting: New York City.
Date of next meeting: May 4-7, 1937.

NORTH CAROLINA

D. L. Pridgen, President.....Fayetteville
E. M. Medlin, Vice President.....Aberdeen
J. F. Reece, President Elect.....Lenoir
F. O. Alford, Secretary-Treasurer.....Charlotte
Place of next meeting: Pinehurst.
Date of next meeting: May 3-5, 1937.

NORTH DAKOTA

F. B. Peik, President.....Carrington
W. S. Shaw, President Elect.....Fargo
Russell A. Sand, Secretary.....Fargo
L. C. Schmitz, Treasurer.....Jamestown
Place of next meeting: Fargo.
Date of next meeting: May.

OHIO

Earl G. Jones, President.....185 E. State St., Columbus
Walter J. Pryor, President Elect.....669 Rose Bldg., Cleveland
Edward C. Mills, Secretary.....255 E. Broad St., Columbus
Harry Cope, Treasurer.....327 E. State St., Columbus
Place of next meeting: Columbus.
Date of next meeting: Nov. 8-10, 1937.

OKLAHOMA

A. B. Rivers, President.....Okmulgee
W. S. Phillips, President Elect.....McAlester
O. W. Boyer, Secretary.....Perry
O. F. Sinks, Treasurer.....504 Medical Arts Bldg., Tulsa
Place of next meeting: Tulsa.
Date of next meeting: April 4-7, 1937.

OREGON

Frank Mihnos, President.....Selling Bldg., Portland
M. C. Harris, President Elect.....Tiffany Bldg., Eugene
F. W. Hollister, Secretary-Treasurer.....Selling Bldg., Portland
Place of next meeting:
Date of next meeting:

PANAMA

B. L. Warner, President.....Ancon
Gerald J. Gabriel, Secretary-Treasurer.....Gorgas Hospital, Ancon
Place of next meeting: Colon.
Date of next meeting: June 12, 1937.

PENNSYLVANIA

Walter E. Mendel, President.....405 Ohio St., Pittsburgh
Fred D. Miller, President Elect.....1122 Twelfth Ave., Altoona
Thomas P. Fox, Secretary.....1614 Locust St., Philadelphia
John H. Corcoran, Treasurer.....Scranton Life Bldg., Scranton
Place of next meeting: Pittsburgh.
Date of next meeting: May 4-6, 1937.

PUERTO RICO

Jose Vicente, President.....San Juan
Jose Vincente, President Elect.....San Juan
Juan Font Suarez, Secretary.....Santurce
L. Ramirez Santibenez, Treasurer.....San Juan
Place of next meeting: San Juan.
Date of next meeting: November, 1937.

RHODE ISLAND

Morris Le Bow, President.....223 Thayer St., Providence
Edwin K. Devine, Secretary.....49 Ravenswood Ave., Providence
Edward C. Morin, Treasurer.....188 Main St., Pawtucket
Place of next meeting:
Date of next meeting:

SOUTH CAROLINA

J. S. Morgan, President.....Union
G. A. Bunch, President Elect.....Cheraw
T. C. Sparks, Secretary-Treasurer.....Medical Bldg., Columbia
Place of next meeting: Columbia.
Date of next meeting:

SOUTH DAKOTA

G. G. Kimball, President.....Mitchell
R. I. Wood, President Elect.....Sturgis
Ernest W. Elmen, Secretary.....Sioux Falls
J. W. King, Treasurer.....Aberdeen
Place of next meeting: Mitchell.
Date of next meeting: May 10-11, 1937.

TENNESSEE

Claude R. Wood, President.....Medical Arts Bldg., Knoxville
J. M. Rodgers, President Elect.....Chattanooga Bank Bldg., Chattanooga
E. J. Justis, Secretary-Treasurer.....708-710 Exchange Bldg., Memphis
Place of next meeting: Knoxville.
Date of next meeting: May 10-13, 1937.

TEXAS

A. L. Nygard, President.....Medical Arts Bldg., Dallas
R. C. Cooley, President Elect.....2517 Gulf Bldg., Houston
J. G. Fife, Secretary-Treasurer.....433 Medical Arts Bldg., Dallas
Place of next meeting: Houston.
Date of next meeting: May 17-20, 1937.

UTAH

W. W. Merrill, President.....Logan
E. W. Lambert, President Elect.....Judge Bldg., Salt Lake City
W. L. Warburton, Secretary-Treasurer.....Medical Arts Bldg., Salt Lake City
Place of next meeting: Logan.
Date of next meeting: June 10-12, 1937.

VERMONT

C. I. Taggart, President.....Burlington
H. E. Spear, Secretary.....Swanton
Thomas A. Norton, Treasurer.....Rutland
Place of next meeting:
Date of next meeting:

VIRGINIA

Carter Crafford, President.....Medical Arts Bldg., Norfolk
A. M. Wash, President Elect.....Medical Arts Bldg., Richmond
J. E. John, Secretary-Treasurer.....Medical Arts Bldg., Roanoke
Place of next meeting: Virgina Beach.
Date of next meeting: May 10-12, 1937.

WASHINGTON

T. M. Barlow, President.....Bellingham Nat'l Bank Bldg., Bellingham
J. H. Whisler, President Elect.....Field & Lease Bldg., Centralia
A. W. Jeffery, Secretary-Treasurer.....Medical & Dental Bldg., Seattle
Place of next meeting: Bellingham, Wash.
Date of next meeting: May 3-5, 1937.

WEST VIRGINIA

C. Baxter Morris, President.....Logan
E. D. Douglass, President Elect.....Parkersburg
C. G. Anderson, Secretary.....Mt. Hope
John S. Stone, Treasurer.....Clarksburg
Place of next meeting: Bluefield.
Date of next meeting: May 17-19, 1937.

WISCONSIN

M. C. Hansen, President.....Racine
E. C. Wetzel, President Elect.....Majestic Bldg., Milwaukee
E. E. Parkinson, Secretary.....104 King St., Madison
W. J. Morrisey, Treasurer.....Reedsville
Place of next meeting: Milwaukee.
Date of next meeting. April 19-22, 1937.

WYOMING

E. E. Andrews, President.....Cheyenne
C. H. Carpenter, Vice President.....Casper
L. A. French, Secretary.....Thermopolis
J. E. Beal, Treasurer.....Casper
Place of next meeting: Casper.
Date of next meeting: June 21-22, 1937.

CURRENT LITERATURE

Substitutes for Gold in Dental Fillings (Berlin Letter) (J.A.M.A., 107:1824 [Nov. 28] 1936): Recently, German dentists discussed the important economic question of finding a substitute for the large amount of gold used in dentistry. Normally, German dentists used about 5,000 kg. (about 11,000 pounds) of gold annually. It has been possible to decrease this amount by 45 per cent in the past few years. In their search for substitutes, the dental practitioners have turned to platinum base alloys and other new metals which contain gold in varied amounts. Those who advocate these new metals "doggedly insist that the new metal should by no means be considered a gold substitute, but a new working medium."

M. K. HINE.

Evaluation of Dental Roentgen Findings in Relation to Focal Infection and Systemic Disease (Herman A. Osgood, Am. J. Roentgenol., 36:751 [Dec.] 1936): One should remember that (1) the teeth are by no means the only source of focal infection and (2) the problem is primarily one of resistance and immunity. Many patients show infection about the teeth and yet have no evidence of systemic disease resulting therefrom. Furthermore, the disease about the teeth may be the result of a general systemic condition or lowered resistance, and not the cause. The type of reaction as seen in the roentgenogram will indicate in general whether the patient's resistance to infection is high or low. Prognosis after treatment depends on (1) the type of region and (2) the amount of denudation of the pericementum and erosion of the root tip. Acute abscesses and granulomas may undergo repair when the cause has been removed. Chronic abscesses with scar bone formation may be walled off, but rarely repaired. A tooth from which the pulp has been removed should not be considered a "dead tooth" if its pericemental attachments and investing structures are normal.

J. FRANK HALL.

Etiology, Pathology and Treatment of Leukoplakia: Report of 316 Cases (F. P. McCarthy, Arch. Derm. & Syph., 34:612 [Oct.] 1936; abstr. J.A.M.A., 107:1838 [Nov. 28] 1936): The author is convinced that in a high percentage of cases of extensive leukoplakia of the tongue, the predisposing factor is atrophic glossitis of syphilitic origin, occurring in untreated or inadequately treated patients with syphilis of long standing. Elsewhere in the mouth, there appears to be no relation between syphilis and leukoplakia. Constitutional conditions have been suggested as predisposing the patient to leukoplakia. A lack of vitamin A or a hereditary predisposition to degeneration or atrophy of tissue may be important. Leukoplakia is overwhelmingly prevalent in men. The course of the disease depends entirely on the cause and the preventive and local treatment. Except for the preventive form of treatment (removal of irritating conditions) the treatment of leukoplakia is unsatisfactory. The use of radium and caustics is contraindicated, as there is a possibility of initiating malignant change in the lesion. Surgical removal of the malignant lesion is indicated in some cases, but unless the local irritation is eliminated, leukoplakia will recur.

M. K. HINE.

Preoperative Estimation of Anesthetic and Surgical Risk (P. D. Woodbridge, Am. J. Surg., 24:410 [Dec.] 1936): Adverse factors are usually striking from the usual history, physical examination and laboratory data. Careful preparation of a poor risk often results in a good risk. Patients should be graded by some scale indicating good, fair, poor and dangerous risks. Age, weakness, a depressed psychic state, obesity or loss of weight, persistent vomiting and

intestinal obstruction are handicaps for anesthesia and surgery. Since anesthesia disturbs oxygen metabolism, mechanical obstruction to breathing, diminution of vital capacity and anemia should be considered as danger signs. The cardiovascular system is best evaluated by questioning the patient regarding dyspnea and chest pain. The author suggests a grading of cardiovascular disease. Coronary occlusion, angina pectoris, congestive failure and syphilitic aortitis carry high operative mortality rates. Uncomplicated high or low blood pressure carries little added risk. Hepatic insufficiency may be minimized by liberal premedication with carbohydrates. Preoperative preparation is usually necessary for the diabetic. Renal insufficiency increases operative risk. Grading of risks in toxic thyroid disease and great care will prevent most fatal postoperative thyroid cases. Addison's disease, chronic alcoholism, infection and recent major operations are adverse factors. "Skill of the anesthetist is the most important factor in the determination of the anesthetic risk."

HAMILTON ROBINSON.

Close Roentgen Irradiation as Substitute for Radium Therapy (Berlin Letter) (J.A.M.A., 107:1823 [Nov. 28] 1936): In the treatment of cancer, radium therapy has heretofore been regarded as superior to roentgen irradiation, especially in cancers of skin, lip, oral cavity and female genitalia. The radium supply is inadequate to care for all cases. In view of this situation, Chaoul experimented with the so-called "close" roentgen irradiation and found the hitherto assumed superiority of radium lay in the method of application rather than the quality of the rays. By considerably shortening the "focus skin distance," use of "soft rays" and restriction of the field of irradiation to the diseased area, Chaoul found that results could be obtained by irradiation which were similar to results obtained from radium therapy. He reports skin carcinoma, 93 per cent cured; cancer of the lip, 83 per cent cured, and cancer of oral cavity, 45 per cent cured.

M. K. HINE.

Preanesthetic Medication (F. A. D. Alexander and Stuart C. Cullen, Am. J. Surg., 34:428 [Dec.] 1936): Preanesthetic preparation protecting the patient from mental discomfort concerns the modern anesthetist as intimately as protection from physical discomfort operatively. The operative preparation should include suppression of fear, gaining of confidence, depression of general metabolism, obtunding of reflex irritability without depression of normal involuntary functions and protection against untoward reactions to anesthesia or operation. Since fear has a most damaging effect, too much emphasis cannot be placed on the importance of reassurance in addition to drug therapy in the production of psychic sedation. A good night's rest before the day of operation is important. The metabolic state should approximate the basal level for the individual. Age, fever, pain, emotional states, muscular development and toxemia are factors in changing the metabolic rate. Opiates, particularly morphine, are the most efficient preoperative drugs. Paraldehyde, the belladonna group (atropine, and scopolamine), barbituric acid derivatives, ephedrine, bulbocapnine, and eserine are discussed as preoperative drugs. The danger of indiscriminate clinical use of barbiturates is pointed out. The author feels that no single drug or combination of drugs can be suited to all purposes, but that the best results are obtained by weighing the various influences, considering the various drugs and then, after making a choice, observing and recording the results.

HAMILTON ROBINSON.

Material Transference of Fluorine (Editorial, J.A.M.A., 107:1970 [Dec. 12] 1936): Although it has been demonstrated that fluorine causes mottling of the enamel of teeth, little attention has been given to pathways of fluorine into the organism other than through drinking water and food. That fluorine can pass the placenta and gain entrance to the fetus has been shown recently by Murray *(J. Physiol.,* 87:388 [Sept.] 1936); also, there is excretion of fluorine through the milk of the

mother. This indicates that mottling of the temporary teeth may result from maternal fluorosis. It is also mentioned that fluoride is present in certain samples of rock phosphate which may be used for fertilizer for farm and garden crops. Thus, one may be exposed to fluorine even in regions where it does not occur naturally.

M. K. HINE.

FOREIGN LITERATURE

Mixed Tumor of Palate (W. G. Evans, Brit. M. J., 2:1141 [Dec. 5] 1936): The author gives a detailed report of a case from its first appearance in 1909, describing operations at various times and following the case to the last recent operation in 1935. The so-called "mixed salivary gland tumors" of the palate are extremely rare. The origin of these mixed tumors of the palate is a subject of controversy. There seems little to support the view that they arise from embryonic salivary gland rests or from sequestrated fragments of salivary gland tissue. Histologic evidence reveals that palatal tumors as well as mixed tumors of the salivary glands proper are members of a group of epithelial tumors with a characteristic tendency to undergo varying degrees of differentiation. Palatal tumors should be referred to only as mixed tumors of the palate and not mixed salivary tumors.

J. FRANK HALL.

Etiologic Significance of Amidopyrin (Pyramidon) in Agranulocytosis (P. Plum, Acta. Med. Scand. [Suppl.], 78:605, 1936): Since 1933, the use of amidopyrin has been suspected as an etiologic factor in agranulocytosis. Attempts by the author to produce the disease experimentally in disposed persons by administration of small doses of amidopyrin were successful. These experiments were conducted on four human subjects. In one case, necrotic stomatitis was noted. In Denmark, it has been proved that twenty of twenty-one agranulocytosis patients observed within the last one and one-half years had been treated with ordinary therapeutic doses of amidopyrin immediately before the onset. Furthermore, in Denmark, the curve for the increased use of amidopyrin over ten years corresponds to the curve for increase in frequency of agranulocytosis. The author concludes that the use of therapeutic doses of this drug is responsible for a considerable number of cases every year, and agranulocytosis from the use of other substances is rare in the country studied.

HAMILTON ROBINSON.

Causes of Dental Caries (C. Schiotz, Tidsskr. f. d. Norske Laegefor., Aug. 15, 1936, p. 849, abstr. Brit. Med. J.): The author, over a long period of time, has made a study of the teeth of the school children in his vicinity. Of 25,000, he finds 170 possess perfectly healthy teeth. He asserts that the larger percentage of these odontologic paragons hailed from well-to-do homes. In a study made of the children in five institutions, as a whole the dental condition was much better than that of other children who lived in the city. These children received plenty of fresh air with regular hours of sleep, and a well-balanced diet. Their consumption of cod-liver oil and brushing of the teeth was rather irregular. The author concludes that a healthy outdoor life and well balanced diet is more important than the prophylactic action of the toothbrush.

J. FRANK HALL.

Experimental Researches of Acute and Chronic Joint Diseases Through Intravenous Streptococcic Infection (E. Jarlv, Acta. Med. Scand. [Suppl.], 78:379, 1936): Working with a Rosenow strain of anthrotropic streptococci, the author has studied the localization of the infecting organisms in the joints. By means of motion pictures, the movement of the experimental animals was studied and symptoms observed that are missed in usual clinical examinations. These apparently symptomless joints gave positive histologic pictures. The possibility of immunity of certain organs as opposed to selective localization by the bacteria is suggested. The experiments show that the joints are selectively infected by some means.

HAMILTON ROBINSON.

MISCELLANY

BOOK REVIEW

Operative Dentistry. A revision of G. V. Black's Work, with which his "Special Dental Pathology" is combined. By Arthur D. Black, A.M., M.D., D.D.S., Sc.D., Dean and Professor of Operative Dentistry and Oral Pathology, Northwestern University Dental School; four volumes: Volume I, Pathology of the Hard Tissues of the Teeth, Oral Diagnosis, 422 pages, 280 illustrations; Volume II, Technical Procedures in Making Restorations in the Teeth, 313 pages, 350 illustrations; Volume III, The Treatment of Dental Caries, 305 pages, 492 illustrations; Volume IV, Pathology of the Diseases of the Investing Tissues of the Teeth, the Dental Pulp and the Periapical Tissues, 472 pages, 523 illustrations. Price, $4.50 per volume; $16.00 for the set. Seventh Edition. Medico-Dental Publishing Company, Chicago; Henry Kimpton, London; 1936.

There has never been issued from the brain or pen of any one man in dentistry anything to approach this series of books. To Arthur D. Black is due the credit for gathering together this material, and arranging it in consecutive order. This alone was a task calling for years of study, and a very intimate familiarity with the various topics gained by a lifetime association with his father, G. V. Black.

A study of these volumes will reveal an insight into one of the master minds of the profession. G. V. Black touched dentistry at more angles than most men, and wherever he turned his vision, he illuminated the subject with the brilliancy of his genius. These books constitute a treasure-house of scientific knowledge, and the profession is under deep obligation for having thus had placed at its disposal, in such orderly array, the significant developments of this tireless worker.

The attempt to review each one of these four volumes in detail must be reserved for future consideration, but the announcement of the issue comes at a most opportune time. The series were dedicated on the anniversary of Dr. Black's one hundredth birthday, Aug. 3, 1936.

> Truth is within ourselves. . . .
> There is an inmost center in us all,
> Where truth abides in fullness.

NEWS

Dedication of Eastman Dental Clinic in Paris: Work has progressed so rapidly on the million dollar Eastman Dental Clinic, now under construction in Paris, that Dr. Harvey J. Burkhart, director of the Rochester Dental Dispensary and general administrator of the Eastman Foundation, announced recently that it is hoped to finish the entire building in time to hold the dedication ceremonies on July 4, 1937. The president of the French Republic, Mr. Lebrun, Ambassador William C. Bullitt and a number of other leading French and American personalities will be invited to take part in the ceremonies. The clinic was designed to provide free dental service for children less than 16 years of age who are unable to pay. The clinic occupies a large area, and the open land surrounding the clinic will be converted into parks and playgrounds. The work of the Paris Eastman Clinic will be based on that carried out at Rochester, and it should serve as a center for dentists and dental surgeons to carry on research and postgraduate work. It will also aim to teach children and parents the need and value of regular dental work throughout their lives.—*J.A.M.A.*, Jan. 16, 1937.

DEATHS

Alexander, Joseph F., Seattle, Wash.; North Pacific College of Dentistry, 1903; died November 15; aged 64.

Ball, Frank, State Center, Iowa; State University of Iowa, College of Dentistry, 1891; died October 31; aged 69.

Chapman, J. R., Roseburg, Ore.; Washington University School of Dentistry, 1892; died October 15; aged 67.

Clark, Alvin C., New Hampton, Iowa; State University of Iowa, College of Dentistry, 1879; died November 10; aged 82.

Couser, Harry, Manchester, Iowa; State University of Iowa, College of Dentistry, 1919; died October 22; aged 39.

Darby, Franklin B., Elmira, N. Y.; Pennsylvania College of Dental Surgery, 1867; died December 1; aged 90.

Hawley, Francis J., Brooklyn, N. Y.; School of Dentistry University of Pennsylvania, 1904; died November 13; aged 55.

Heatlie, Fred Watson, Goodland, Ind.; Chicago College of Dental Surgery, 1901; died November 26; aged 63.

McLeran, C. S., Audubon, Iowa; Omaha Dental College, 1898; died October 12; aged 60.

Meyer, G. W. C., Oconomowoc, Wis.; Chicago College of Dental Surgery, 1898; died October 31; aged 60.

Miller, Irving U., Brooklyn, N. Y.; New York College of Dentistry, 1905; died October 30.

Noble, S. S., Wichita, Kan.; Kansas City-Western Dental College, 1887; died October 20; aged 73.

Pelka, Frank X., Chicago, Ill.; Chicago College of Dental Surgery; died recently, of pneumonia; aged 43.

Ream, Paul Frederick, Roachdale, Ind.; Indiana University School of Dentistry, 1928; died December 10.

Richardson, Elizabeth E., Redwood City, Calif., College of Physicians and Surgeons, 1901; died November 30; aged 73.

Ritchey, C. E., Colorado Springs, Colo.; Drake University College of Dentistry, 1904; died November 16.

Seeger, C. H., Manitowoc, Wis.; Ohio College of Dental Surgery, 1883; died November 14; aged 76.

Tansey, George G., Smithville, Texas; died November 30; aged 60.

Walser, John, Marshalltown, Iowa; Chicago College of Dental Surgery, 1904; died October 26; aged 55.

Wynn, Erwin Lee, Wichita, Kan.; Kansas City-Western Dental College, 1924; died October 18; aged 36.

ANNOUNCEMENTS*

CALENDAR OF MEETINGS

American Dental Association, Atlantic City, N. J., July 12-16.

American Academy of Restorative Dentistry, Atlantic City, N. J., July 10-11.

American Association of Dental Schools, Baltimore, Md., March 15-17.

American Board of Orthodontia, Chicago, Ill., April 17.

American Dental Society of Europe, Paris, France, August 2-5.

American Society of Oral Surgeons and Exodontists, Atlantic City, N. J., July 9-10.

American Society of Orthodontists, Chicago, April 19-22.

Chicago Dental Society, February 15-18.

Greater Buffalo (N. Y.) Spring Dental Meeting, February 24-26.

International Association for Dental Research, Baltimore, Md., March 13-14.

International Dental Federation, Stockholm, Sweden, July 9-14, 1937.

American Society for the Advancement of General Anesthesia in Dentistry, New York City, fourth Monday in March and October.

Central Pennsylvania Seventh District Dental Society, at Altoona, March 2-3.

Eastern Association of Graduates of Angle School of Orthodontia, Cleveland, Ohio, March 15-16.

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

Five State Post Graduate Clinic, Washington, D. C., March 7-10.

St. Louis (Mo.) Dental Alumni Association Annual Reunion, March 31-April 1.

Pacific Coast Society of Orthodontists, San Francisco, Calif., February 22-24.

Philadelphia County Dental Society, Philadelphia, February 3-5.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

American Dental Assistants Association, Atlantic City, N. J., July 12-16.

Kings County Dental Society, Brooklyn, N. Y., February 17-20.

Australian Dental Congress, Sydney, August 16-20.

STATE SOCIETIES

February

Minnesota, at Minneapolis (23-25)

March

District of Columbia, at Washington (7-10)

April

Alabama, at Mobile (12-14)
California, at San Jose (12-14)
Kentucky, at Louisville (5-7)
Louisiana, at New Orleans (8-10)
Massachusetts, at Boston (26-30)
Michigan, at Detroit (26-28)
Mississippi, at Jackson (5-7)
New Jersey, at Atlantic City (24)
Oklahoma, at Tulsa (4-7)
Wisconsin, at Milwaukee (19-22)

May

Arkansas, at Little Rock (10-12)
Connecticut, at Hartford (5-7)
Georgia, at Savannah (17-19)
Illinois, at Springfield (11-13)
Indiana, at Indianapolis (17-19)
Iowa, at Des Moines (4-6)
Maryland, at Baltimore (3-5)
Missouri-Kansas, at Kansas City, Mo. (16-19)
Montana, at Anaconda (6-8)
Nebraska, at Omaha (17-19)
New York, at New York City (4-7)
North Carolina, at Pinehurst (3-5)
North Dakota, at Fargo
Pennsylvania, at Pittsburgh (4-6)
South Dakota, at Mitchell (10-11)
Tennessee, at Knoxville (10-13)
Texas, at Houston (17-20)
Virginia, at Virginia Beach (10-12)
Washington, at Bellingham (3-5)
West Virginia, at Bluefield (17-19)

June

Colorado, at Colorado Springs (10-12)
Idaho, at Boise
Maine, at Rangeley (25-26)
Nevada, at Reno (5)
New Hampshire, at North Conway (21-22)
New Mexico, at Albuquerque
Panama, at Colon (12)
Utah, at Logan (10-12)
Wyoming, at Casper (21-22)

September

Southern California, at Los Angeles (13-15)

November

Florida, at Hollywood (4-6)
Ohio, at Columbus (8-10)
Puerto Rico, at San Juan

December

Hawaii, at Honolulu

STATE BOARDS OF DENTAL EXAMINERS

Florida, at Jacksonville, June 21. H. B. Pattishall, 351 St. James Bldg., Jacksonville, Secretary.

New Jersey, June 28-July 2. Walter A. Wilson, 148 W. State St., Trenton, Secretary.

MISSOURI-KANSAS DENTAL MEETING

The Missouri-Kansas Dental Meeting will be held in Kansas City, Mo., May 16-19, in the New Municipal Auditorium.

LEON KRAMER, *President,*
Kansas State Dental Association.

FLORIDA STATE BOARD OF DENTAL EXAMINERS

The annual examination for license to practice dentistry and for license to practice dental hygiene will be held in Jacksonville, commencing June 21, at the Seminole Hotel. Preliminary applications must

be filed sixty days prior to date of examination. Address all communications to

H. B. PATTISHALL, *Secretary,*
351 St. James Bldg.,
Jacksonville.

STATE BOARD OF REGISTRATION AND EXAMINATION IN DENTISTRY OF NEW JERSEY

The State Board of Registration and Examination in Dentistry of New Jersey will hold its annual examinations, commencing June 28 and continuing for five days thereafter. On application to the secretary, a copy of the requirements and rules for applicants, instruction sheet and preliminary application blank will be sent. Any person desiring to become a candidate must file the preliminary application together with the examination fee of $25 on or before March 15 for the June examinations or before September 1 for the December examinations.

WALTER A. WILSON, *Secretary,*
148 W. State St.,
Trenton.

AMERICAN SOCIETY OF ORAL SURGEONS AND EXODONTISTS

The American Society of Oral Surgeons and Exodontists will be held in Atlantic City, N. J., July 9-10. Headquarters, Hotel Chelsea.

HARRY BEAR, *Secretary,*
410 Professional Bldg.,
Richmond, Va.

PACIFIC COAST SOCIETY OF ORTHODONTISTS

The Pacific Coast Society of Orthodontists will hold its next meeting February 22-24 at the Palace Hotel, San Francisco, Calif. Members of the profession who are in the exclusive practice of orthodontia are cordially invited to attend.

EARL F. LUSSIER, *Secretary,*
450 Sutter St.,
San Francisco, Calif.

CENTRAL PENNSYLVANIA SEVENTH DISTRICT DENTAL SOCIETY

The thirty-fifth annual meeting of the Central Pennsylvania Seventh District Dental Society will be held at the Penn Alto Hotel, Altoona, March 2-3.

J. L. PORIAS, *Recording Secretary,*
Nanty-Glo.

GREATER BUFFALO SPRING DENTAL MEETING

The Greater Buffalo Spring Dental Meeting sponsored by the University of Buffalo School of Dentistry Alumni Association will be held February 24-26, at the Hotel Statler, Buffalo. Requests for preliminary program should be addressed to

FRANK A. WOODWORTH, *President,*
1317 Hertel Ave.,
Buffalo.

ST. LOUIS UNIVERSITY DENTAL ALUMNI ASSOCIATION

The St. Louis University Dental Alumni Association Annual Reunion will be held March 31-April 1.

PAUL F. O'BRIEN, *Chairman,*
Publicity Committee,
4209 S. Kingshighway Blvd.,
St. Louis, Mo.

JOURNAL OF DENTAL RESEARCH

The *Journal of Dental Research* is now being offered to members of the American Dental Association at $4 a year (six issues comprising an annual volume) as organization subscribers. Subscriptions for 1937 should be sent to the Committee on Publication, 260 Crittenden Blvd., Rochester, N. Y.

M. K. HINE,
HAROLD C. HODGE,
HAMILTON ROBINSON,
Committee on Publication.

"PREVENTIVE DENTISTRY IN THE INTEREST OF HEALTH" TO BE THEME OF 1937 A.D.A. MEETING

From a recent meeting of the Local Arrangements Committee of the 1937 A.D.A. Meeting at Atlantic City, N. J., comes the news that Leroy M. S. Miner, President of the American Dental Association, has selected the theme for the meeting to be held next July 12-16. The very fitting subject of "Preventive Dentistry in the Interest of Health" has been chosen by Dr. Miner as the keynote of the convention.

That our President should consider the preventive aspects of our profession in relation to health as deserving of special emphasis at an annual meeting is indeed a tribute to dentistry's lofty aspirations. While the statement of the theme may seem to be in the nature of a slogan, it is more than that—it can better be considered a pronounced principle.

Of course, this does not mean that the subject of prevention will force all other matters of interest and importance to the profession into the background. Rather will it increase the enthusiasm of every branch and service of dentistry as it is linked with the prevailing theme of the convention. All sections will present their own subject matter in their own way, the usual attention being given to every phase of the practice of dentistry, merely dovetailing the various phases with the main thought of the meeting—prevention.

It is indeed a wonderful opportunity for us to go forward in promoting the preventive aspects of dentistry both within and without the profession. We are offered a vehicle on which we can ride to new heights in the service of health. Let us extend ourselves to the limit in expounding "Preventive Dentistry in the Interest of Health."

LOCAL ARRANGEMENTS COMMITTEE.

OFFICERS AND TRUSTEES OF THE AMERICAN DENTAL ASSOCIATION
1936-1937

PRESIDENT

Leroy M. S. Miner.....363 Marlborough St., Boston, Mass.

PRESIDENT ELECT

C. Willard Camalier.....1726 Eye St., N.W., Washington, D. C.

VICE PRESIDENTS

Raoul H. Blanquie.....Flood Bldg., San Francisco, Calif.
James V. Gentilly.....Rose Bldg., Cleveland, Ohio
James A. Blue.....Comer Bldg., Birmingham, Ala.

SECRETARY

Harry B. Pinney.....212 E. Superior St., Chicago, Ill.

TREASURER

R. H. Volland.....First Capital Nat'l Bank Bldg., Iowa City, Iowa

BOARD OF TRUSTEES

Leroy M. S. Miner, President, Ex-Officio....363 Marlborough St., Boston, Mass.
C. Willard Camalier, President Elect, Ex-Officio.....
.....1726 Eye St., N.W., Washington, D. C.
Harry B. Pinney, Secretary, Ex-Officio.....212 E. Superior St., Chicago, Ill.
R. H. Volland, Treasurer, Ex-Officio.....
.....First Capital Nat'l Bank Bldg., Iowa City, Iowa
Harvey J. Burkhart, '39.....Box 879, East Avenue P. O., Rochester, N. Y.
C. R. Lawrence, '39.....730 Bass Bldg., Enid, Okla.
Herbert C. Miller, '39.....E. 6th and Oregon Sts., Portland, Ore.
Wilfred H. Robinson, '39.....1706 Broadway, Oakland, Calif.
J. Ben Robinson, '38.....Medical Arts Bldg., Baltimore, Md.
Thomas L. Grisamore, '38.....29 E. Madison St., Chicago, Ill.
E. G. Meisel, '38.....121 University Place, Pittsburgh, Pa.
C. J. Caraballo, '38.....Stovall Bldg., Tampa, Fla.
George E. Morgan, '38.....2039 North Prospect Ave., Milwaukee, Wis.
J. G. Hildebrand, '37.....Waterloo, Iowa
Albert R. Ross, '37.....Murdock Bldg., Lafayette, Ind.
Oren A. Oliver, '37.....Medical Arts Bldg., Nashville, Tenn.
Philip E. Adams, '37.....106 Marlborough St., Boston, Mass.